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COLOR AS PREDICTOR OF PERCEIVED EFFECTIVENESS OF SUPPLY AND DEMAND LINE GRAPHS

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ABSTRACT

This study investigates whether increases in a color stimulus were in any way predictive of the perceived effectiveness of a supply and demand line-graph among college students. Differences in gender as well as perception variation in direct relation to the intensity of color changes were tested, across grade levels, ages, and incomes of undergraduate business majors. We used MANOVA and Multiple Regression techniques for data analysis. The results suggest intensity of color significantly influences the magnitude of perception of the effectiveness of a supply and demand line-graph.

INTRODUCTION

Communication of complex information through the use of color exists throughout recorded history. Color appears in Egyptian hieroglyphics depicting ritualistic incantations showing a pharaoh's safe passage to eternal existence. Sketches on Mayan temple walls show human sacrifices in Pre-Columbian South America. The United States of America flag's colors of red, white, and blue symbolize the ideals of the republic—democratic freedom won through revolution. Color mixing appears throughout history in symbolic depictions of human rituals, political messages, and the iconic representations of religious creeds.

The use of color in graphic materials to transfer meaning appears commonplace on college campuses. Color mixing is apparent in the pedagogic practices of teachers of economics (Kaufman & Kaufman, 2002). By using colorized visual illustrations of complex subject matter to aid student learning, professors assume color will enhance student learning.

Unfortunately, many college level teaching practices are arbitrary. Teachers often use the same methods learned from their teachers. Thus, the colorized materials teachers embrace to enhance student learning deserve scientific investigation. The practice of using color to enhance instruction (i.e., the presentation of complex graphs) is rarely supported by empirical evidence.

The field of psychology pioneered much of our understanding of how the sensation of color contributes to learning. In 1802, Sir Thomas Young postulated red, green, and blue receptors in the human eye are required to see all colors (see Darley, Glucksberg, & Kinchla, 1991). With better access to the anatomy of the human eye, the consensus among present day scientists is the primary colors red, yellow, and blue in combination produce any hue detectable by humans. The color spectrum yields 350,000 different color sensations; however, humans distinguish only 150 of those (Hochberg, 1978).

Two theorists, Ernst Weber and Stanley Stevens, whose theories can substantiate the instructional validity of the use of color in academic content delivery, are pioneers in the field of perception and sensation thresholds.

Weber's Law

One of the prominent theories, attributed to Ernst Weber, a 19th century experimental psychologist, is conceptually simple. The smallest amount of change in stimulation that can be detected 50 percent of the time is the absolute threshold or just noticeable difference (JND). Different types of stimuli (temperature, shock, brightness, etc.) create a different JND. Weber (1838) hypothesized the size of the JND relates constantly to the initial stimulus. This relationship between stimulus and threshold known as Weber's Law expressed in a formula is:

$$\frac{\Delta \mathrm{I}}{\mathrm{I}} = k$$

In this equation, □I represents the change in the stimulus and I represents the initial stimulus. The constant "k" represents the proportion between the change and the initial stimulus. Weber (1838) believed that this proportion remains constant relative to the initial stimulus.

Steven's Power Law

Stanley S. Stevens (1957) enunciated a law relating the objective, instrument-measured intensity of a stimulus to its intensity as perceived by humans. Steven's law says the magnitude of the perceived intensity always relates to the magnitude of the physical intensity raised to some power. Steven's Power Law is defined as follows:

$$\Psi = k\,\Phi^{n}$$

where Ψ is the perceived intensity, Φ is a measure of the physical intensity, and k and n are constants. In this study, we use Steven's theory to show the intensity of color added to a supply and demand line-graph will vary with sensation of perceived effectiveness of that graph.

Weber's Law and Steven's Power Law on sensation thresholds demonstrate how sensations affect human perception in direct relation to sensation intensity. The literature shows color sensation contributes to our understanding of how color enhances student learning when integrated with content delivery.

RELATED LITERATURE

Wheelbarger (1970), tested theories in audiovisual education that held learning from a visual illustration directly relates to the realism of the visual aid. Four groups saw slide sequences with illustrations having a different degree of realism: line drawing (black and white), line drawing (color), shaded drawing (black and white), and shaded drawing (color). The fifth group saw a slide presentation with words only. The results of the study showed no significant difference among the five groups' learning achievement.

Winn and Everett (1979) used respondent's ratings of color and black-and-white slides to explore the effect of grade level and gender on affective ratings of those pictures. Pruisner (1993) conducted a study to determine the impact of color on learning. There were four treatment groups in this study, (1) color-cued presentation, color-cued assessment; (2) color-cued presentation, black/white assessment; (3) black/white presentation, color-cued assessment; and (4) black/white presentation, black/white assessment. Pruisner determined the preferred presentation type was color-cued and that the presence of a systematic color cue enhanced performance.

Mitchell, Scriven, and Wayne (1995) analyzed the relationship of four presentation methods—text, tabular, black-and-white graphics, and color graphics—to the level of retention, reader reaction, and reading time. The study found that the incorporation of color graphics increased psychological reaction, but does not always improve task performance. Vastola and Walker (1995) discussed a computer application that used animation, graphics, and color to make the learning of statistical reasoning easier and more entertaining. Sinclair, Soldat, and Mark (1998) examined the differences in students' performance on two identical midterm examinations printed on different colored paper. The results suggested that by providing affective information, external cues could influence students' processing strategy and examination performance. Clariana (2004) investigated the instructional effects of color when learning from computer displays. Screen color showed more influence on learning than question type or question difficulty.

Noiwan and Norcio (2006) conducted an experimental study that investigated the effects of animated graphic colors on attention and perceived usability of users from two cultural groups. Their study suggested influences of culture on overall performance, retention, and self-reports on usability regardless of differences in color combinations.

Publishers began offering colorized textbooks en masse as early as 1960. Subsequently, colorized graphic illustrations inundated most textbooks. Business textbooks on the same subjects (e.g., microeconomics or business communication) now display a high degree of homogeneity. Kaufman and Kaufman (2002) shed light on the particular problems economics professors face when teaching introductory courses. Kaufman and Kaufman (2002) stated:

> Because the classroom explanation and graphical manipulations usually happen only once, the logical progression and development of the economic model can be very difficult for students to replicate in their lecture notes. Textbooks are limited to written explanations and static illustrations; they cannot capture or animate the step-by-step dynamics of an economic model and its application. (p. 296)

Kaufman and Kaufman (2002) believe colorized interactive graphs are more useful to students than traditional methods of presenting graphs that are limited to written explanations and static illustrations.

While we found published articles with relevance to the scope of this study, none of the literature review revealed studies conducted in a rural setting specific to understanding the predictive effect of color intensity (physical sensation) relative to perceived sensation (an effectiveness score). Nonetheless, the literature review provided an important understanding of colorized visual aid usage and their viability for instructional purposes across many grade levels. Colorized materials, especially colorized graphs used by economics professors, need further examination. To fill this void in the literature, this study investigated whether the physical sensation of color added to a supply and demand line-graph was predictive of perceived sensations (the strength of sensation or what Steven, 1956, called magnitude estimates).

METHODOLOGY

SAMPLE AND PROCEDURE

A survey was administered primarily to business students enrolled at a rural Midwestern university. The students responded to the effectiveness of different multi-color graphs (six versions of the same supply-demand graph) on a seven-item Semantic Differential scale. In order to investigate whether the order of appearance of these graphs and the order of responses on the scale made any statistical difference, this study used two versions of the survey – Form A and Form B. The sample consisted of 219 completed surveys. To conserve space, the survey instrument and only Form A are shown in the Appendix.

The two forms differed in the order of appearance of the graphs. The Semantic Differential scales were reversed between them (i.e., 1 was least effective and 7 was most effective in Form A and the reverse was true in Form B). Prior to performing any statistical analyses, these scales were recoded to make the scales consistent between the two forms (i.e., after recoding, 1 represented least effective and 7 represented most effective in both forms). The questionnaire included five demographic variables – class standing, major, gender, age, and income level. We used traditional multivariate statistical procedures and systematic data collection procedures.

DESCRIPTIVE DATA

Table 1a and Table 1b present the frequency statistics for the five demographic variables. The 219 respondents included freshmen, sophomores, juniors, and seniors. The respondents' majors were Accounting, Management, Marketing, Finance, MIS, Double-major, and Non-business. The respondents consisted of 117 female students and 102 male students. The 219 students were classified by age in the 17-26 age group, in the 27-36 group, and in the 36+ group. The following income levels were used: less than \$10,000, between \$10,000-\$30,000, between \$31,000-\$50,000 and more than \$51,000.

Table 1a: Frequency of Demographic Variables Class Standing and Major

Class Standing	Frequency	%
Freshman	14	6.4
Sophomore	72	32.9
Junior	71	32.4
Senior	62	28.3
Major	**Frequency**	**%**
Accounting	34	15.5
Management	86	39.3
Marketing	43	19.6
Finance	22	10.0
MIS	15	6.9
Double Major	5	2.3
Non-Business	14	6.4

Table 1b: Frequency of Demographic Variables Gender, Age, and Income

Gender	**Frequency**	**%**
Female	117	53.4
Male	102	46.6
Age	**Frequency**	**%**
17-26	211	96.3
27-36	5	2.3
36+	3	1.4
Income Level	**Frequency**	**%**
<10 k	150	68.5
10-30 k	65	29.7
31-50 k	2	0.9
51k +	2	0.9
TOTAL	**219**	**100**

Presented in Table 2 are the mean and standard deviation of students' responses to the effectiveness of the multi-color graphs. The mean responses reveal that students generally perceive graphs with more colors to be more effective vis-à-vis graphs with fewer colors.

Table 2: Graphs, Means, and Standard Deviations

Graphs	*Mean*	*SD*
Six Color A	5.04	1.82
Five Color	5.00	1.52
Six Color B	4.84	1.80
Four Color	4.79	1.43
Three Color	4.47	1.49
Two Color	3.61	1.74

HYPOTHESIS TESTING

This study investigated if an increase in color stimulus was predictive of students' perceptions of a line-graph's effectiveness. In addition, this study set out to determine if there were any significant differences in students' perceptions of multi-color graphs across demographic variables (gender, class standing, major, income, and age). The formal hypotheses are stated as follow:

Hypothesis $_1$: Color (physical sensation) is not predictive of students' perceptions (perceived sensations) of the effectiveness of a multi-color supply and demand line-graph.

Hypothesis $_2$: Demographic variables are not predictive of students' perceptions (perceived sensations) of the effectiveness of a multi-color supply and demand line-graph.

Hypothesis $_3$: Student's perceptions of the effectiveness of a multi-color supply and demand line-graph do not vary across demographic characteristics.

RESULTS

REGRESSION AND MANOVA ANALYSES

A multiple regression analysis was performed that sought to ascertain the predictive influence of color and demographic variables on students' perception of the effectiveness of multi-color graphs. The regression results are summarized in Table 3A (combined sample), Table 3B (Form A only), and Table 3C (Form B only). Of the 219 respondents, 108 completed Form A and 111 completed Form B. Each respondent evaluated six graphs. The total number of observations is as follows: both forms combined – 1,314; Form A – 648; and Form B – 666. The dependent variable is the effectiveness for each graph. The independent variables are demographic variables and the attributes of multi-color graphs.

To account for heteroscedasticity, which was confirmed by the White's Test, the regressions were estimated with Heteroscedasticity-Consistent robust estimators. The estimated results in Table 3A suggest the perceived effectiveness of graphs (in both forms combined) is strongly affected by attributes of color.

Table 3A: Multiple Regression Model – Combined Sample

Variable	Coefficient	t statistics	Variable	Coefficient	t statistics
Constant	3.31	23.61	Six Color B	1.22	7.28***
Three Color	0.86	5.62***	Age (27-36)	-0.97	-3.05***
Four Color	1.18	7.96***	Female	-0.19	-2.13**
Five Color	1.40	9.13***	Management	0.18	2.04**

Six Color A	1.43	8.47***	Form A	0.68	7.74***

*significant at 10%; **significant at 5%; ***significant at 1%

Diagnostic Statistics

n = 1,314	Adjusted R^2 = 0.14
Overall significance test	F statistic = 19.84 (p value = 0.00)

Compared against two-color graphs (black and white only – the base category for the dummy variable capturing the color attribute), all other attributes (three, four, five, and six color graphs) have statistically significant positive coefficients. The findings suggest incorporating more colors (one color at a time) make the same graph appear more effective. For example, using three colors instead of two colors (black and white) increases the effectiveness of the same graph by an average of 0.86 points (on a seven-item scale) and five colors increases the effectiveness of a two-color graph by an average of 1.4 points. Among the other variables, age (27-36), female, management, and Form A were statistically significant.

Our results showed female students are more likely than male students to perceive the same graph as less effective, and students completing Form A are more likely to perceive the same graph as more effective compared with students completing Form B. Therefore, gender difference and the order of graphs seem to be important determinants of effective perception of color. Although the adjusted R^2 for the estimated model is low, the F statistic suggests that the independent variables are highly significant as a group.

Two separate regression models were estimated with data from Form A and Form B. The estimated results, as shown in Tables 3B and 3C, suggest that attributes of color are still highly significant in each model. Results from all models consistently validate the hypothesis that intensity of color stimulus is perceptually related to a supply and demand line-graph's effectiveness.

Table 3B: Multiple Regression Model – Form A

Variable	Coefficient	t statistics	Variable	Coefficient	t statistics
Constant	4.13	29.56	Six Color B	1.06	4.93^{***}
Three Color	0.96	5.52^{***}	Age (27-36)	-0.88	-1.78^{*}
Four Color	1.38	8.23^{***}	Female	-0.21	-1.84^{*}
Five Color	1.52	8.82^{***}	MIS	-0.39	-2.04^{**}
Six Color A	1.40	6.79^{***}	Accounting	-0.38	-2.38^{**}

*significant at 10%; **significant at 5%; ***significant at 1%

Diagnostic Statistics

n = 648	Adjusted $R^2 = 0.14$
Overall significance test	F statistic = 12.78 (p value = 0.00)

Based on these results, we reject Hypothesis 1. Color appears to be a statistically significant predictor of students' perceptions of the effectiveness of a multi-color supply and demand line-graph. Additionally, statistical evidence suggests age, gender, and some majors, are important predictors of students' perceptions. Therefore, we reject Hypothesis 2 for these characteristics. Since we did not find such evidence for all demographic characteristics, we cannot reject Hypothesis 2 for all demographic characteristics.

Table 3C: Multiple Regression Model – Form B

Variable	Coefficient	t statistics	Variable	Coefficient	t statistics
Constant	3.33	17.14	Six Color A	1.46	5.46***
Three Color	0.76	3.08***	Six Color B	1.38	5.36***
Four Color	0.99	4.12***	Age (27-36)	-1.05	-3.65***
Five Color	1.28	5.14***			

*significant at 10%; **significant at 5%; ***significant at 1%

Diagnostic Statistics

n = 666	Adjusted R^2 = 0.08
Overall significance test	F statistic = 9.94 (p value = 0.00)

Table 4A: Two-Way MANOVA Test Statistics: Both Forms (n=219)

Source	Wilks' Lambda	Df	F Statistic	p-value
Model	0.4765	16	1.64	**0.0002**
Class Standing	0.9077	3	1.08	0.3695
Major	0.8191	6	1.12	0.2892
Gender	0.9708	1	0.99	0.4346
Age	0.8987	2	1.80	**0.0460**
Income	0.9499	3	0.57	0.9224

In order to test Hypothesis 3, data were analyzed using two-way MANOVA tests. The computed test statistics (*Wilks' Lambda*) reported in Table 4A show there appear to be statistically significant differences across the entire model (p value = 0.00). When the model is disaggregated, the test statistics show statistically significant differences in students' responses across age (p value = 0.046) and forms (Form A vs. Form B) (p = 0.0002).

These results are validated by outcomes from mean comparison tests. The p-values of testing the hypotheses of no significant differences between the mean vectors of students' responses across demographic variables showed Leadership to be different than MIS majors with p = .0554 and students ranging in age from 17-27 differed with students ranging from ages 28-37 with p = .0046. These results suggest significant differences in students' responses across some demographic variables (MIS major vs. Leadership major and age group 17-27 vs. 28-37).

Based on these results, we conclude that there is statistical evidence to suggest that students' responses significantly differ across some demographic characteristics (age and some majors), but not across all demographic characteristics; therefore, we reject Hypothesis 3 only for age and majors, but not for all demographic characteristics.

DISCUSSION

In Exhibit 1 in the Appendix, we present color increase ratios of 1.00, 0.50, 0.33, 0.25, and 0.20 respectively according to Weber's Fraction, assuming a student would notice each color added as a sensation threshold. The relationship between stimulus and threshold is quantified by the application of the equation stated in Weber's Law. Displayed in Exhibit 1 are the ratios (calculated from Weber's fraction) for adding one color, beginning with black and white, to a supply and demand line-graph:

$$\frac{\Delta \mathrm{I}}{\mathrm{I}} = k$$

Our regression models support Steven's Power Law, more so than Weber's law. We found using three colors instead of two colors (black & white) increased the perceived effectiveness of the same graph by an average of 0.86 points (on a seven-item Semantic Differential scale, our magnitude estimate is 0.86/7.0 = 12%). Four colors increased the perceived effectiveness of a two-color graph by an average of 1.18 points (on a seven-item Semantic Differential scale, our magnitude estimate is 1.18/7.0 = 17%). Five colors increased the perceived effectiveness of a two-color graph by an average of 1.4 points (on a seven-item Semantic Differential scale, our magnitude estimate is 1.40/7.0 = 20%). Six colors increased the perceived effectiveness of a two-color graph by 1.33 points (average of forms A and B) (on a seven-item Semantic Differential scale, our magnitude estimate is 1.33/7.0 = 19%).

Weber's law asserts the relationship between the stimulus and threshold should be 50% (using three colors rather than a two-color graph) and 25% (using five colors rather than a two-color graph). Contrary to Weber's Law, we did not find perceived sensation to be constant in relation to the initial stimulus.

Weber's law receives criticism for its inability to explain sensation at the upper and lower limits of sensation. For example, Weber's law is useful in explaining why one pound added to a five-pound load is more detectable than one pound added to a one hundred pound load; however, human beings have difficulty in sensing weight at either the upper or lower limits of human sensation. In some cases, understanding how physical sensation affects perceived sensation at the upper or lower limits is essential. Professors who add colors to a supply and demand line graph should be able to justify the practice. Using color to enhance learning should be more than an arbitrary practice.

We now know the amount of color is significantly predictive of students' perceptions of the effectiveness of a multi-color supply and demand line-graph. More color added to a supply and demand line-graph significantly influenced students' perceptions of the effectiveness of the same line-graph; furthermore, the significant differences found in our regression models were not directly proportional to the amount of the initial color stimulus. Thus, our findings did not support Weber's law. The initial stimulus (two colors) was not constantly proportional to the perceived effectiveness of a line-graph and perceptions did not remain constant despite variations in colors added to six versions of the same line-graph.

We believe because we used only six colors out of 150 colors detectable by humans, the effect of adding one color to two colors, then one color to three colors, then one color to four colors, and so on is analogous to adding one pound to a five-pound load.

Our models are consistent with Steven's Power Law where Ψ is the perceived intensity, Φ is a measure of the physical intensity, and k and n are constants.

$$\Psi = k\,\Phi^{n}$$

Student numerical responses signifying their perceived sensation (1 = not effective to 7 = effective as a magnitude estimate) show Steven's Power Law provides a better explanation of our findings.

Our regression models show the amount of physical sensation (color) on perceived sensation does in fact vary according to the amount of color stimulus represented on a multi-color supply and demand line-graph. More color meant a higher effectiveness score; in other words, the magnitude of the perceived intensity related directly to the magnitude of the physical (color added) intensity.

The amount of perception varied with the amount of color on a multi-color graph; each color added to a supply and demand line-graph meant a significantly higher effectiveness score as perceived by students. Sir Thomas Young (1802) identified red, green, and blue as primary colors. Interestingly, Six Color Graph A, which contained those colors, received the highest mean score of 5.04. Furthermore, Six Color Graph B, containing primary colors red, yellow, and blue, ranked third with a mean of 4.84.

Teachers using transparencies and presentation software can make use of these findings by integrating a multi-color supply and demand line-graph very easily into the unit where the concept of supply and demand is covered. In fact, textbook publishers supply professors with numerous teaching tools and visual aids, including PowerPoint presentations for every chapter.

Testing students' perception of the effectiveness of a colorized supply and demand line-graph confirms the soundness of using color in an introductory economics course. Using more than six colors on a line graph is apparently unnecessary. In this study, the supply and demand line-graphs students viewed reflect only six of the 150 colors the human eye detects, which is a small fraction of the 350,000 possible colors in the visual spectrum.

We do not know if adding seven or more colors to a supply and demand line-graph would lead to diminishing returns. We do not know if seven or more colors added to a supply and demand line-graph would be optimal or too many. We do not know if other types of graphs (pie charts, bar charts, etc.) with colors added would yield changes in terms of perception of their effectiveness. Many questions concerning color are beyond the scope of this particular study. These questions open up possible avenues for further research.

CONCLUSION

Professors at the regional university where the study took place should utilize multi-color supply and demand line-graphs when covering the material about the relationship between supply and demand in their introductory economics courses.

Using three colors instead of two increased the perceived effectiveness of the same graph by an average of 12%. As the number of colors increased, the perceived effectiveness of the graphs increased incrementally. Six colors increased the perceived effectiveness of a two-color graph by 19%).

Additionally, statistical evidence suggests age, gender, and some majors are important predictors of students' perceptions of the perceived effectiveness of the number of colors used on a supply and demand graph. However, we did not find such evidence for all demographic characteristics.

Finally, we conclude there is statistical evidence to suggest students' responses significantly differ across some demographic characteristics (age and some majors), but not across all demographic characteristics.

LIMITATIONS

Because the study was conducted at only one university, findings cannot be generalized to other institutions. A multi-campus study should be conducted in order to ascertain a deeper understanding of the difference between certain demographic characteristics and the perceived effectiveness of additional colors. Our study used only six colors and two hundred and nineteen subjects. Subsequent studies may utilize additional colors or fewer colors and a larger sample.

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APPENDIX

Exhibit 1:

Weber's Fraction for a Supply and Demand Line-Graph Adding One Color at a Time*

Weber's Fraction For A Two Color (Black and White) Line-Graph: delta I = 2 colors – 1 color = 1 color; delta I/I = 1/1 = 1.00 or a JND of 100 percent.

Weber's Fraction For A Three Color Line-Graph: delta I = 3 colors – 2 color = 1 color; delta I/I = ½ = 0.50 or a JND of 50 percent.

Weber's Fraction For A Four Color Line-Graph: delta I = 4 colors – 3 color = 1 color; delta I/I = 1/3 = 0.33 or a JND of 33 percent.

Weber's Fraction For A Five Color Line-Graph: delta I = 5 colors – 4 color = 1 color; delta I/I = ¼ = 0.25 or a JND of 25 percent.

Weber's Fraction For A Six Color Line-Graph: delta I = 6 colors – 5 color = 1 color; delta I/I = 1/5 = 0.20 or a JND of 20 percent.

*It is an assumption students are able to detect one color added to each graph with proportionality.

Please provide your demographic information. .

My Major is: Accounting __, Management __, Marketing __, Finance __, MIS __, or a

Double Major in: _________and ________or other/non-business_______

My gender is: Male _______ or Female _______

My age is: (17 to 27)________, (28 to 37)________, or (older than 38) ________

My Income is: Less than $10,000____ $10,000-$30,000____ $31,000-$50,000____ or

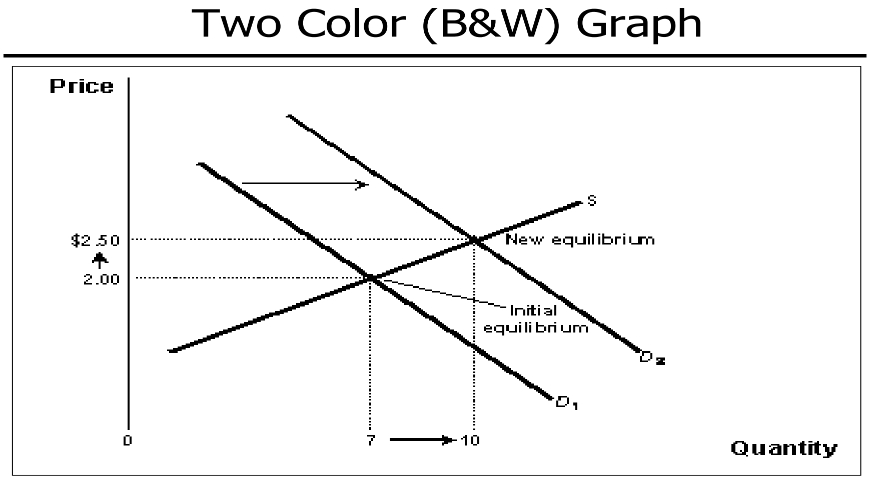
$51,000+____

I am enrolled as a: Senior _____, Junior _____, Sophomore _____, or Freshman _____

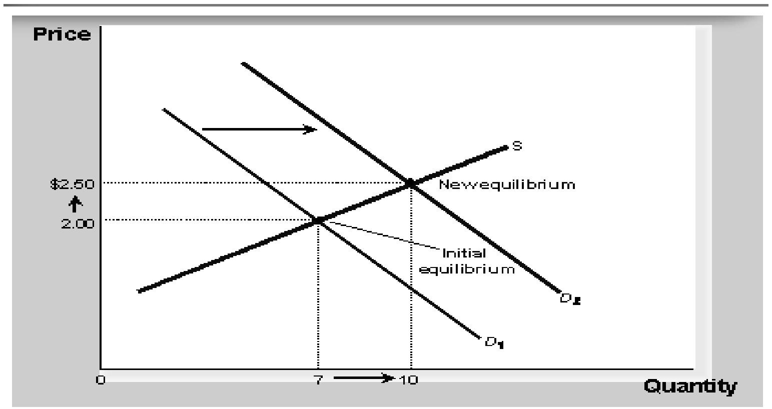
In general, the theory "supply and demand" asserts that where goods are traded in a free market at a price where consumers demand more goods than firms are prepared to supply, this shortage allows the suppliers to increase their prices; thus increased demand will tend to drive up the price of the goods. Those consumers that are prepared to pay more will bid up the market price. Conversely prices will tend to fall when the quantity supplied exceeds the quantity demanded. This price/quantity adjustment mechanism causes the market to approach an equilibrium point, a point at which there is no longer any impetus to change. This theoretical point of stability is defined as the point where producers are prepared to sell exactly the same quantity of goods as the consumers want to buy. Retrieved from Wikipedia (2007). [supply and Demand Defined] http://en.wikipedia.org/wiki/Supply_and_demand

Form A

Please circle the number best representing your perception of the graph's level of effectiveness.

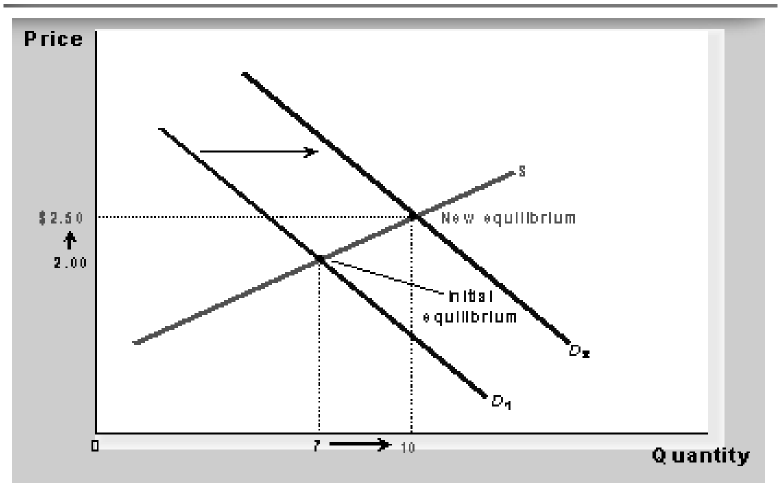

Two Color (B&W) Graph

Not Effective 1 2 3 4 5 6 7 Effective



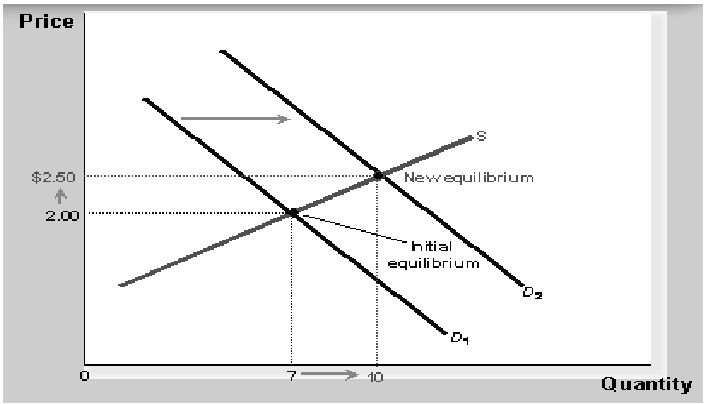
Three Color Graph

Not Effective 1 2 3 4 5 6 7 Effective



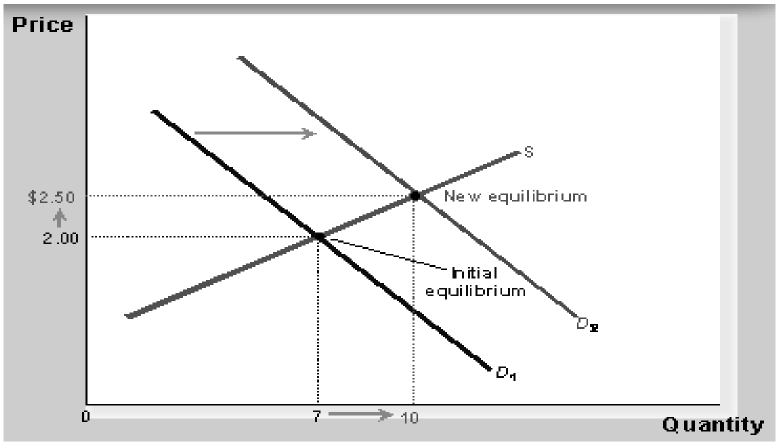
Four Color Graph

Five Color Graph



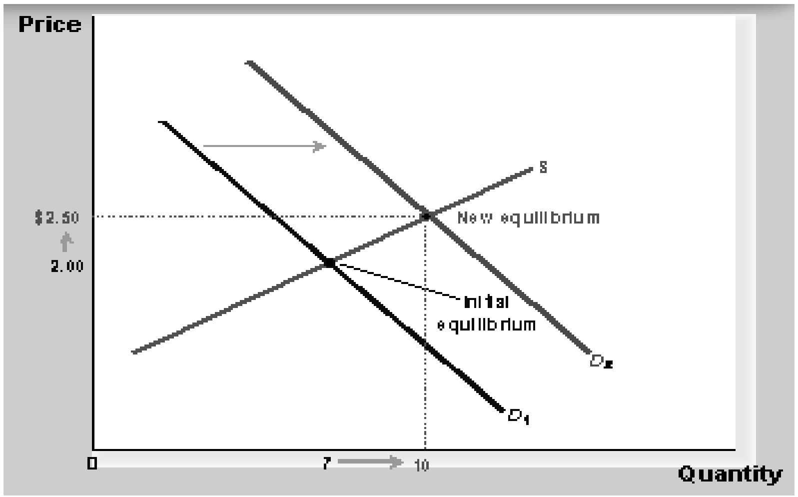
Not Effective 1 2 3 4 5 6 7 Effective

Six Color Graph - A



Not Effective 1 2 3 4 5 6 7 Effective

Six Color Graph - B



Not Effective 1 2 3 4 5 6 7 Effective

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