AN EXPLORATORY STUDY OF COLOR PREFERENCE AND AWARENESS IN THE CLOTHING CLASSROOM AS RELATED TO ABILITIES AND INTERESTS OF THE STUDENT

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CHAPTER I

INTRODUCTION

The field of college teaching in home economics presents many possibilities for graduate study. Clothing is one of the major areas embodied in the broad scope of home economics. The training students receive in clothing is concerned with the development of particular skills as well as the acquisition of aesthetic tastes and sound artistic judgement. The degree to which the students profit from training may depend to some extent upon the type of classroom in which the training is received. The color environment appears to be an important factor in contributing to the effectiveness of the classroom surroundings.

An issue which goes beyond the relationship between color environment and proficiency of performance is concerned with the association between the recall of colors experienced in the classroom and aspects of behavior like aptitude, artistic interest, and capacity to recognize colors of increasing degrees of complexity. The need to understand more clearly the relationship between color experience and various facets of personality may lead to a more complete understanding of the influences of color on behavior.

The study was formulated as an outgrowth of professional experiences, both as a homemaking teacher in a public high school and as a graduate assistant in the Clothing, Textiles, and Merchandising Department at Oklahoma State University.

Problem

Color is one of the important components of the environment. It seems to exercise some influence on the moods and behavior of human beings. The association between color environment and proficiency of performance continues to be an area of concern. Another area is the relationship between color experience and certain characteristics of human behavior. Efforts were made to explore the latter. The problem investigated was concerned with the study of color preference and awareness in the clothing classroom as related to abilities and interests of the student.

Purposes of the Study

The purposes of the investigation need to be clearly delineated in order to get a clear understanding of the relationship of the hypotheses to be tested and the objectives to be achieved by the research. It is sometimes difficult to differentiate between the two. The purposes underlying the study were:

(1) To identify differences, if any, in the number and order of colors which could be recalled by students in three varying color environments.

(2) To determine if a correlation existed between the type of color recalled and the degree of its preference in the clothing classroom.

(3) To determine the statistical relationship, if any, between (a) number and (b) order of rankings and (c) intelligence, (d) artistic interest, and (e) recognition of color.

Hypotheses Underlying the Study

In order to undertake a systematic analysis of the questions raised in the investigation it was necessary to express clearly the hypotheses to be tested. The statistical treatment employed demanded that the questions be stated in precise form. The following hypotheses are relevent to the study:

(1) When given the opportunity, students will recall and rank with higher preferences those colors in display areas in the classroom where emphasis is expressed with accent colors.

(2) The drab, conventional colors of the classroom will be given lower preference.

(3) The order in which colors will be recalled is related to interests and abilities.

(4) The number of colors recalled by the students is related to interests and abilities.

Assumptions of the Study

The assumptions underlying the investigation were a basis for recognizing ideas which may be employed, in part, in setting up the hypotheses to be tested. The assumptions should be brief, yet pertain directly to the basic issues to be studied. The assumptions in the study were as follows:

(1) Those colors which were not remembered at all were those least preferred and to which the student was least aware.

(2) Room A was an aesthetically colorful room and on this basis the best of the three rooms in the experiment.

(3) Room B was moderatly colorful and, therefore, was second in its relationship to the other classrooms.

(4) Room C was void of accent color and, therefore, was the poorest of the three classrooms.

Significance of the Study

The research evidence available seemed to indicate that color affects the behavior of human beings. "As long as information has been recorded of man and his activities color has played an important role in every phase of life."[1] Through the ages color has been employed as one of the media to portray the inner feelings of man. In recent years a large body of knowledge has accumulated relative to the influence of color on the attitudes and preferences of individuals in school and industrial settings.

Knowledge of the effect of color on the individual in the school environment has influenced classroom planning. William Caudill, noted architect, stated that school planning should hold the student as the first consideration.[2] In addition to physical requirements such as warmth, illumination, and quiet, the psychological factors should be considered. Schools must fill both physical and emotional needs.[3]

There is considerable research to indicate that color, used

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[1]H. V. Webb, "Light and Color: Aids to Learning," American School Board Journal, CXXXV (1957), p. 42.

[2]William W. Caudill, Toward Better School Designs, (New York, 1954), p. 2.

[3]Ibid.

effectively in the classroom, can improve performance of the student. "Scholastic achievement and behavior of pupils improve markedly when pleasing color is introduced into the classroom."[4] Three schools which needed repainting were used as experiments. One was left unpainted; the second was painted the conventional light buff walls with white ceilings; the third was painted with a cheerful yellow for halls, gray doors, classrooms on the north a pale rose, and classrooms on the south cool blues and greens. Over a two year period the "psychologically" painted school showed greatest improvement in each of seven performance tests studied. The traits studied were social habits, health and safety habits, work habits, language arts, arithmetic, social studies and science, art and music.[5] An expert has observed " In every classroom proper light and color can contribute substantially toward improving the learning process."[6]

The evidence indicated that the types of colors present in the classroom influenced the behavior of the student and, as a consequence, affected the kind of learning that took place. Attempts to understand the reasons for these changes in behavior have been given limited attention. It would seem helpful, therefore, to ask questions concerning the relationship between the color experiences of the students and aspects of behavior like intelligence, artistic interst, and capacity to recognize colors of varying degrees of complexity. The relationships

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[4]Howard Ketcham, Color Planning for Business and Industry, (New York, 1958), p. 97.

[5]Ibid.

[6]Webb, p. 42.

brought to light may give some insights into the extent to which number and order of colors recalled are related to the subjects' perceptual and psychological characteristics.

Limitations of the Study

Research designs are generally limited in one or more respects. The restrictions may be imposed by the nature of the design or by limitations in methodology. The limitations of the study appear to center around (1) the small number of cases available for the research and (2) lack of immediate opportunity to repeat the study with similar classes to determine if the results obtained in the initial study could be replicated.

CHAPTER II

REVIEW OF THE LITERATURE

Psychology of Color

Research on the psychological aspects of color is difficult for the mere reason that human emotions are none too stable and the psychic make-up of human beings varies from person to person. However, there are a number of general and universal reactions to color.[7]

Warm colors are stimulating; conversely, cool colors are subduing. The most exciting colors are in the red and orange group. Subduing colors are in the violet range, while tranquility is induced by green.[8] Since it is true that visual comfort is more dependent on brightness than hue, greens are no "easier on the eyes" than other colors. "But green, being 'nature's' color, to which we are well adjusted, does offer a good deal of psychological comfort because of this fact."[9]

Emotions of people seem to be influenced by aesthetics. Birren states that "Color is emotional, and emotion is far more spontaneous

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[7]Faber Birren, Color Psychology and Color Therapy, (New York, 1950), p. 142.

[8]"Emotional Reaction to Color," DuPont Color Conditioning Report No. 3, (Wilmington).

[9]Ibid.

than reason or logic."[10] Reactions to color are well established in that color can excite, depress, delight, annoy, soothe or irritate according to the combination of colors used.[11]

Psychologists have pointed out that aesthetic surroundings affect the individual's perception. Maslow and Mintz conducted an experiment to study the initial effects of aesthetic surroundings upon people.[12] Three visual-aesthetic conditions were used: "beautiful," "average," and "ugly" rooms. Each subject spent ten to fifteen minutes in the room. In each room subjects unaware of the experimental purpose were asked to rate "fatigue/energy" and "displeasure/well-being" of ten negative print photographs of human faces. The ratings of the group in the "beautiful" room were significantly higher than either the "average" or "ugly" rooms. The "average" room group received somewhat higher ratings than the "ugly" room group. The mean score for the "beautiful" room fell in the "energy and well-being" range while the means for the ratings of the other two rooms fell within the "fatigued and displeased" range.[13] This would indicate physical environment has a psychological effect upon perception.

Mintz extended the study to test the effect of continued and

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[10]Faber Birren, Color in Your World, (New York, 1962), p. 13.

[11]Architectural Specification Manual, Pratt and Lambert, Inc., (9th ed., New York), p. 192.

[12]A. H. Maslow and N. L. Mintz, "Effects of Esthetic Surroundings: I, Initial Effects of Three Esthetic Conditions upon Perceiving 'Engergy' and 'Well-being' in Faces," The Journal of Psychology, XLI (1956), pp. 247-254.

[13]Ibid.

prolonged aesthetic environment.[14] Subjects spent at least one hour per day for three weeks in two rooms. The "beautiful" room was colorfully decorated while the "ugly" room was an unsightly, unkept storeroom. The results were that these naïve subjects consistantly rated the faces higher in the "beautiful" room.[15]

Those in the "ugly" room finished more quickly than those in the "beautiful" room. Observational notes showed those in the "ugly" room had reactions of monotony, fatigue, headache, sleep, discontent, irritibility, hostility, and avoidance. Those in the "beautiful" room displayed comfort, pleasure, enjoyment, importance, and a desire to continue their activity.[16] These reactions are applicable to the classroom situation.

The Maslow and Mintz studies have shown the effects of visual-aesthetic conditions on the perceptual experience. The nature of the perceptual experience was consistent regardless of the different time exposures to the conditions employed in the experimental rooms. In the investigation described in the present report the time exposure in the three rooms was longer. The subjects spent four to five hours per week in the classroom over an eight week period. The present investigation was not concerned with perceptual change as a result of stimulation from the environment, but with the influences of environment upon the recall of colors and the relationship of recall to certain measurable characteristics of behavior.

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[14]Norbett L. Mintz, "Effects of Esthetic Surroundings: II, Prolonged and Repeated Experience in a 'Beautiful' and an 'Ugly' Room," The Journal of Psychology, XLI (1956), pp. 459-466.

[15]Ibid.

[16]Ibid.

Color in Education

Kling equates good education with a good and beautiful school.[17] Although some modern school critics point out that some of our best-educated citizens are products of classes held in basements with poor lighting, he thinks there will always be geniuses emerging from the worst of conditions. "But, all conditions being equal, there can be no disputing the advantages of the beautiful environment over the indifferent one."[18]

With today's new concepts in education comes a different way of thinking about learning and about the relationship of the school building to the experience of learning. Progressive educators are concerned with the conscious attempt of influencing the mood and attitude of students.[19]

There is some evidence, however, that there is a lag in actual practice of this theory. Although one should not have to defend beauty in a school building, the beautiful school is not easily justified to the public.[20]

To point out that it works as well, even turns out good students, is not enough to appease a skeptical public, which believes that beauty in schools is too costly. We feel a little guilty about creating beauty in public works, even when the cost is the same; indeed it sometimes

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[17]Vincent G. Kling, "Beauty in Schools," School Executive, LXXVIII (1959), p. 22.

[18]Ibid.

[19]Lawrence B. Perkins, Work Place for Learning, (New York, 1957), p. 5.

[20]Kling, p. 21.

seems that we gain a sense of virtue from a stern denial of viewing something pleasing.[21]

The terms "schoolhouse brown," "hallway cream," and "machine gray" are still used today.[22] These phrases have come into use because of the traditional sterotype of colors used in schools. "What could be less invigorating to the students and less conducive to good mental attitudes for learning."[23]

Research conducted by the Pittsburgh Plate Glass Company indicated that dull, drab surroundings in the classroom contribute to absenteeism and to a lack of interest, while correct use of color helped to foster a desire to keep the pleasing environment neat and orderly.[24]

The British Ministry of Education and local education authorities have done some excellent work in using a "scientific color approach" in their schools. The results were due to research conducted by architects and educators guided by members of the Ministry of Education. "The 'traditional' interior colors of green and brown that have been used so long in British schools were never considered when these schools were painted."[25]

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[21]Ibid.

[22]Webb, p. 43.

[23]Ibid.

[24]Color Dynamics for Schools, Pittsburgh Plate Glass Company, (Pittsburgh), p. 2.

[25]Lawrence E. Gowin, "World of Sunshine in Britain's New Schools," School Executive, LXXVII (1957), p. 75.

British educators and architects have taken advantage of research conducted in other fields which showed that color offers efficient control of brightness and glare, aids visual acuity, lessens fatigue, and definitely contributes to human competence.[26] Other research indicated colors have a definite effect on children's behavior and academic achievement.

The Southern Beaver County Joint School system had consolidated several rural areas and both elementary and secondary schools achieved very desirable results with the effective use of color and light.[27]

Caudill expressed the need for schools to show consideration for the emotional needs of the students. Pupils of all ages were sensitive to color.[28] It has been found that an attractive classroom serves as a background for the students' learning. "Certainly the learning environment influences each child's currivulum experience."[29]

Color in Industry

"The same basic factors which made color a productive industrial asset can be applied with equal effectiveness in making the school a better place in which to carry on the educational processes."[30] The basic aim is to provide an environment that will stimulate the mental

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[26]Ibid., p. 74.

[27]"Accent on Color and Light," Nations Schools, LX (1957), p. 74.

[28]Caudill, p. 10.

[29]Ruth G. Strickland, "Creating A Challenging Classroom Environment," The Reading Teacher, XV (1961), p. 194.

[30]Color Dynamics, The Scientific Utilization of the Energy in Color, Pittsburgh Plate Glass Company, (Pittsburgh), p. 11.

processes and reduce muscular tiredness caused by eyestrain.

Some positive results of the correct use of color are better morale, greater safety, more efficiency and less waste, reduction of nervous tension and eyestrain, better workmanship, higher output, less absenteeism, fewer accidents, and better labor-management relations.[31] Other research indicates that, in addition to the above factors, labor turnover is reduced.[32]

Correct coordination is necessary because if a worker is continuously exposed to only one color, no matter how pleasant it may be, he is using nerve endings in only one part of his eye. This results in early fatigue and upholds the theory that there is a need for color variation.[33]

Color Therapy

A great part of innate color preference is traceable to the physiological effects of color. Red will increase blood pressure, respiration rate, and muscular tension. Blue light and color will retard them. There will be greater arousal of the entire body, more positive cortical activation (brain waves) for red than blue. "This means we are affected by color whether we want to be or not."[34]

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[31] Ketcham, p. 90.

[32] Color Dynamics, How J & L Utilizes the Energy in Color, Pittsburgh Plate Glass Company, (Pittsburgh).

[33] Ketcham, p. 92.

[34] Faber Birren, Color in Your World, (New York, 1962), p. 18.

Certain practitioners in the field of medicine use color in treatment of patients. Blue has been prescribed to cure headaches, high blood pressure of nervous origin, and insomnia. Activity of hormones is increased by red. Yellow helps raise blood pressure associated with anemia.[35]

Color can affect in a positive or negative manner the mildly neurotic tendencies of hysteria, fears, insomnia, obsessions, phobias, insensitivity, delusions, anxieties, loss of memory, stuttering, tics, and other symptoms.[36]

Mentally retarded subjects were significantly more productive verbally on colored pictures than on non-colored ones. They also produced a greater number of themes when telling stories about the colored pictures. "If color is added to a picture the productivity of mentally retarded individuals is increased."[37]

A common and important form of monotony in long-term hospitilization is related to the patient's surroundings. Color and variety may be combined to serve as a potent agent in minimizing this type of monotony. From the standpoint of color therapy, the patients room is the most important single unit.[38] Color may cause excitation or

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[35]Faber Birren, Color Psychology and Color Therapy, (New York, 1950), pp. 109-110.

[36]Faber Birren, Color in Your World, (New York, 1962), p. 118.

[37]Nathan M. Lubin, "The Effect of Color in the TAT on Productions of Mentally Retarded Subjects," American Journal of Mental Deficiency, LX (1955), p. 370.

[38]Samuel M. Reichel, "Color Therapy for Environmental Monotony in Chronic Disease Hospitals," Journal of the American Hospital Association, XXX (1956), pp. 54-55.

depression, a quickening of nervous response, or an effect of tranquility.

In the field of human behavior, it has been definitely established that color not only has a physiological effect on the human eye and nervous system but also has a profound psychological reaction on the mind. Certain colors have the power to elevate the mind while others can blunt the nervous system and act as depressants. Still others create confusion. The mental and physical reactions of a person can be changed by color.[39]

The literature illustrates again the influence that color has on the behavior of individuals. Despite the extensive research in the area described in this section and in earlier sections, no consistent efforts have been made to study the relationship between factors like the number and the order of colors recalled, and the measurable traits of intelligence, artistic interest, and capacity to recognize colors.

No evidence has been brought to light after a careful perusal of of the literature to indicate that the study has duplicated previous research efforts. In this respect the investigation differs from types of studies reported in the literature.

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[39] Color Dynamics, The Scientific Utilization of the Energy in Color, Pittsburgh Plate Glass Company (Pittsburgh), p. 7.

CHAPTER III

PROCEDURE

Types of Information to be Collected

The steps involved in obtaining the data are outlined below. The information presented should clarify the methodological procedures employed in the study.

Manuals containing directions and information about tests employed in securing part of the data are listed at the bottom of the page. Data collected for testing the assumptions proposed in the investigation were: (1) level of intelligence as measured by the Otis Quick-Scoring Mental Ability Test (Gamma AM);[40] (2) artistic interest as measured by the artistic scale of the Kuder Preference Record (Form C);[41] (3) recognition of color as measured by the Recognition of Color Test (Subtest 9) of the Lewerenz Tests in Fundamental Abilities of Visual Art;[42] (4) the order of rankings of colors recalled; and (5) the number of rankings of colors recalled.

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[40]Arthur S. Otis, Manual for the Otis Quick-Scoring Mental Ability Test, (New York, 1954).

[41]G. Frederic Kuder, Administrator's Manual of the Kuder Preference Record (Vocational Form C), (Chicago, 1960).

[42]Alfred S. Lewerenz, Manual of Directions for Lewerenz Tests in Fundamental Abilities of Visual Art, (Los Angelos, 1927).

The students who served as subjects were pleased to be able to participate in the investigation. None declined to take part.

Subjects

The subjects were females who were enrolled in clothing classes in the College of Home Economics at Oklahoma State University in the spring semester, 1963. The students selected attended class a comparable number of hours per week in the rooms in which the study was conducted. Group I consisted of 14 subjects who attended class in Room A four to five hours per week; Group II was made up of 34 students who attended class in Room B four to five hours per week; Group III consisted of 24 students who met in Room C four to five hours per week. In Room A one-half of the girls were taking advanced work in clothing while the balance were taking beginning work. All the students in Rooms B and C were taking beginning work.

Table I presents the mean age in months of the students tested in each

TABLE I

MEAN AGES AND STANDARD DEVIATIONS IN MONTHS FOR STUDENTS IN EACH OF THE THREE GROUPS

	Mean	Standard Deviation
Group I (N=14)	242.79 (20.26 yrs.)	9.12 (.76 yrs.)
Group II (N=33)	225.94 (18.83 yrs.)	5.39 (.45 yrs.)
Group III (N=24)	224.67 (18.72 yrs.)	6.80 (.57 yrs.)

of the three groups. The females in Group I were approximately two years older than those in Groups II and III. When the t-test was employed to test the significance of the differences between the mean

ages of Groups I and II and Groups I and III, it was observed that the differences were greater than could be expected to occur by chance. Table II showed that the t-values for both differences fell below the one per cent confidence level. The difference between the mean ages of Groups II and III was not statistically significant.

TABLE II

THE T-VALUES FOR THE DIFFERENCES BETWEEN MEAN AGES IN MONTHS FOR THE THREE GROUPS

Group	Degrees of Freedom	t-value	Probability
I vs. II	45	8.69	<.01
I vs. III	36	6.10	<.01
II vs. III	55	.85	>.10

Classrooms

The three classrooms in which the students met from four to five hours per week were located on the second floor of Home Economics West on the Oklahoma State University campus. Each room was assigned to the Department of Clothing, Textiles, and Merchandising for instructing students. Room A was an aesthetically colorful room and possessed several pleasing color combinations. Room B was a moderately colorful room but not as aesthetically pleasing as Room A. Room C was void of accent color and the poorest of the three.

Description of Tests Employed

Data were obtained in part by using the following psychological measuring devices:

(1) The Otis Quick-Scoring Mental Ability Test (Gamma AM); this test is suitable for college students; it consists of 80 mixed items arranged in order of difficulty covering vocabulary, sentence meaning, problems, number series, and analogies; it has a 30 minute time limit and a split-half reliability of .90;[43] validity coefficients based upon criteria such as success in school and success on the job have been reported in various studies to range from .30 to .59.[44]

(2) Artistic Scale of the Kuder Preference Record (Form C); is one of the two scales of the Kuder Preference Record and is presumed to indicate interest in doing creative work involving color and design; the scale has a split-half reliability of .90;[45] a validity coefficient of .39 was found between scores on the artistic scale of the Kuder and grades in a basic art course offered at Oklahoma State University.

(3) Recognition of Color, a Subtest of the Lewerenz Tests in Fundamental Abilities of Visual Art; this subtest employs a color chart with six known colors at the top and 46 "unknown" variations below, divided into four sections; the initial letter of the known six colors is employed to indicate, by means of a multiple choice technique, the one predominant known color in

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[43] Donald E. Super and John O. Crites, Appraising Vocational Fittness, (New York, 1962), p. 104.

[44] Ibid, p. 105.

[45] Ibid, p. 471

each of the unknowns; the test has a 20 minute time limit and the score is the number correct; the instrument appears to measure capacity to make both gross and fine discriminations among colors of varying degrees of complexity; the reliability of the subtest for the small sample in this study, when assessed by a modified form of the method of rational equivalence, was .69; the only validity data available are reported in a study by Wallis [46] in which he correlated the total score on the nine tests with the Meier-Seashore and McAdory Tests of artistic ability and obtained correlations of .53 and .58 respectively.

The tests were administered during the class session to the members of each of the three groups. The Kuder Preference Record was administered in its entirety; only the results from the artistic scale were employed in the analysis. The only portion of the Lewerenz Tests administered to the subjects was the Recognition of Color Test.

Ranking of Colors Recalled

In addition to the test data obtained on the instruments described above, other information was secured. Each of the students in the three classrooms was requested to recall the colors in their respective classrooms and rank them in order of recall. The ranking was done in other rooms in the building. The subjects had been meeting class for eight weeks when requested to do this task. The procedure allowed the subjects freedom to place the responses in

[46] Ibid, p. 312.

the order in which they were recalled. No other restrictions were imposed except that they were instructed to use not more than 15 minutes in making the rankings. Instructions for making the rankings are given in Appendix A.

Steps Utilized in Analyzing the Data

The analyses mentioned below were undertaken in order to test the assumptions made in this study. The data for each of the three groups were treated separately. The outcomes of the analyses and the inferences to be drawn from them appear in subsequent sections of the report. The steps undertaken were as follows:

(1) The final order of merit of colors recalled for each group was assessed based on a scale of 100 points. This required transmuting orders of merit into "per cent positions." These per cents were transmuted into scores by means of tables.[47] The final rank order of colors for each group was based on the averages of the transmuted scores.

(2) The means and standard deviations of the data for each of the three groups were obtained on (a) the Otis Quick-Scoring Mental Ability Test (Gamma AM); (b) the artistic scale of the Kuder Preference Record (Form C); (c) the Recognition of Color Test (Subtest 9) of the Lewerenz Tests; (d) the number of colors ranked based on recall.

(3) The order of ranking of colors recalled in each of the three

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[47] Henry E. Garrett and R. S. Woodworth, Statistics in Psychology and Education, (New York, 1958), p. 329.

groups was correlated with (a) the Otis Quick-Scoring Mental Ability Test (Gamma AM); (b) the artistic scale of the Kuder Preference Record (Form C); (c) the Recognition of Color Test (Subtest 9) of the Lewerenz Tests; (d) the number of colors ranked based on recall.

(4) Intercorrelations were computed among the following measures in each of the three groups: (a) the Otis Quick-Scoring Test (Gamma AM); (b) the artistic scale of the Kuder Preference Record (Form C); (c) the Recognition of Color Test (Subtest 9) of the Lewerenz Tests; (d) the number of colors ranked based on recall.

The tetrachoric correlation technique was employed in determining the correlation coefficients between variables. The cosine formula [48] was utilized which made it possible to read the tetrachoric r from a table which supplied the cosines of angles from 0 to 90°. A limitation in the use of tetrachoric r involves the mathematical complexity of its standard error; its deviation is exceedingly difficult and it was not attempted here. In practice tetrachoric r tends to be somewhat less stable when N is small and the cutting scores depart from .50. [49]

Tetrachoric r and Spearman rho were utilized in computing certain of the correlation coefficients early in the analysis. Since the results were generally comparable, it was decided to employ tetrachoric r throughout in order to reduce the labor of computation. The

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[48] Ibid.

[49] Ibid.

application of the statistical techniques and the analysis of the data are presented in the following section of the report.

CHAPTER IV

ANALYSIS OF RESULTS

Basic Data

An initial step in the analysis was to determine how the data for the various measures employed in the study were distributed. This step involved computing the means and standard deviations for the following: (1) the Otis Quick-Scoring Mental Ability Test; (2) the Artistic Scale of the Kuder Preference Record; (3) the Recognition of Color Test; and (4) the number of colors ranked based on recall.

The results for the Otis Quick-Scoring Mental Ability Test are given in Table III. It appears that the students in Group I, who tended to be older, did somewhat better on the intelligence test. The students in Group II did least well.

TABLE III

MEANS AND STANDARD DEVIATIONS FOR EACH OF THE THREE GROUPS ON THE OTIS QUICK-SCORING MENTAL ABILITY TEST (GAMMA AM)

	Group I	Group II	Group III
	(N=14)	(N=33)	(N=24)
Mean	57.00	48.82	51.54
Standard Deviation	6.64	9.26	7.99

The median raw score on the Otis for the general adult population is 42 and is equivalent to an I. Q. of 100.[50] The average of the means of the three groups is 52 which is equivalent to an I. Q. of 110. The value was employed as the cut in dichotomizing the Otis scores for computing tetrachoric r's between intelligence and the other data. An I. Q. of 110 is representative of the median performance of college freshmen as a group. An I. Q. of 100, as indicated above, is representative of the median performance of the general noncollege population.

The data obtained on the artistic scale of the Kuder are presented in Table IV. The means and standard deviations of scores for each of the groups are fairly comparable. It was decided, however, to select 34 as the cut in dichotomizing the Kuder scores since that represents the point which lies between the one per cent and five per cent

TABLE IV

MEANS AND STANDARD DEVIATIONS FOR EACH OF THE THREE GROUPS ON THE ARTISTIC SCALE OF THE KUDER PREFERENCE RECORD (FORM C)

	Group I (N=16)	Group II (N=34)	Group III (N=22)
Mean	30.94	32.12	31.41
Standard Deviation	10.61	8.65	8.69

[50] Otis, p. 4.

points of significance for normally distributed scores from psychological measures having a reliability of .90. A raw score of 34 on the artistic scale of the Kuder falls at the 75th percentile when compared against norms for women. Scores at or above the 75th percentile may be regarded as indicating interest in artistic activities.

Data for each of the three groups on the Recognition of Color Tests are given in Table V. The means and variabilities of the three distributions are quite similar. Thirty-six was selected as the cut for dichotomizing the scores for determining the tetrachoric correlation coefficients between the recognition of Color Test and the rest of the variables. The cutting score is the average of the means of each of the three groups.

TABLE V

MEANS AND STANDARD DEVIATIONS FOR EACH OF THE THREE GROUPS ON THE LEWERENZ RECOGNITION OF COLOR TEST (SUBTEST 9)

	Group I (N=14)	GroupII (N=29)	Group III (N=25)
Mean	35.50	36.21	36.24
Standard Deviation	1.92	2.29	2.21

Presented in Table VI are the means and standard deviations of the number of colors ranked based on recall. The average number recalled is quite comparable for the three groups. Although the average recalled is not large, the spread for individuals was from three to eleven. For the computation of the tetrachoric correlation coefficients

between the number ranked and the other variables, the distributions of data of number ranked for Groups I and II were cut at seven and for Group III at five.

TABLE VI

MEANS AND STANDARD DEVIATIONS FOR EACH OF THE THREE GROUPS FOR THE NUMBER OF COLORS RANKED BASED ON RECALL

	Group I (N=14)	Group II (N=32)	Group III (N=24)
Mean	6.64	6.75	5.29
Standard Deviation	1.98	1.41	1.07

Order of Ranks

The orders of ranks of colors recalled for individuals in each of the three groups were correlated with level of intelligence, artistic interest, recognition of color, and number of rankings of colors recalled. The order of ranks was divided so that the upper half of ranks for a given color and the lower half of ranks formed a dichotomy. The dichotomizing of order of ranks for facilitating the calculation of tetrachoric r gave results comparable to the Spearman rho which involved a somewhat more laborious computational procedure.

Final Order of Merit of Colors Recalled

Earlier in the study it was indicated that the following hypotheses were to be tested: (1) when given the opportunity, students will recall and rank with higher preferences those colors in display areas

in the classroom where emphasis is expressed with accent colors and (2) the drab, conventional colors of the classroom will be given lower preferences.

To test these assumptions the students in each of the three groups were given 15 minutes to recall colors they had encountered in their classrooms and rank them. Each student prepared independently an order of colors recalled, classifying as number one the first color most readily recalled, number two as the second most readilly recalled, etc. Some students made as few as three rankings, some as many as eleven. The order of ranking of colors for each student was converted into a "per cent position" by subtracting the color's rank from the constant .5, dividing by the number of colors ranked, and multiplying by 100.

From the percentage position each color's "score", on a scale of 100 points, was read from a table.[51] The scores obtained from the table were averaged for each group and the averages arranged in order of merit. The ranks of the colors prepared by the students and the "converted scores" are presented for each of the three groups in Appendixes B-1, B-2, and B-3. Table VII shows the final order of merit of colors for each of the three groups.

It should be noted that in Group I the first five colors in order of merit for the group as a whole are accent colors; yellow, another accent color, is ranked eighth. In Group II red, orange, black, and gold are accent colors; with the exception of gold, the accent colors appear in the upper half of the ranks. There are no accent colors

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[51]Garrett, p. 329.

TABLE VII

FINAL ORDER OF MERIT OF COLORS RECALLED FOR EACH GROUP BASED ON A SCALE OF 100 POINTS

Group 1 N=14	Red	Pink	Green	Turquoise	Gold	Beige	Brown	Yellow	White	Black	Gray
Average	71	58	55	52	58	46	43	42	41	35	30
Order of Merit	1	2	3	4	5	6	7	8	9	10	11

Group 2 N=32	Red	Green	Orange	Beige	Black	Brown	Gold	White	Gray	Metallic
Average	64	63	54	51	47	47	44	39	33	30
Order of Merit	1	2	3	4	5.5	5.5	7	8	9	10

Group 3 N=24	Green	Brown	Beige	White	Gray	Yellow	Black	Metallic
Average	63	59	57	48	41	38	38	34
Order of Merit	1	2	3	4	5	6.5	6.5	8

present in the classroom occupied by Group III. This indicated that in Group I the colors which were recalled and given high rankings were red, pink, green, turquoise and gold. These are five of the six accent colors found in the classroom occupied by Group I. Red green and orange were ranked in the top half of colors recalled by Group II. These represent accent colors in the classroom occupied by Group II. The drab classroom, occupied by Group III, contained no accent colors. Green, which is one of the universally preferred colors,[52] got top ranking; brown, beige, and white, along with green, were in the upper half of ranks. None of the colors in the drab classroom were pleasing. It became a matter of making choices relative to others in the environment. The subjects were forced to give top ranks to colors they did not ordinarily like.

It appeared that in those classrooms where accent colors existed they tended to be recalled and given high rankings. The colors were aesthetically pleasing in the contexts in which they occured and influenced the attention of the students. Students recalled most readily those aesthetic experiences which seemed most satisfying. Aesthetic experiences may motivate behavior by creating states of readiness to perceive and to recall. Pleasant experiences serve as reinforcers of both cognitive and motor processes.

The Relationship of Order of Ranking to Other Variables

One of the hypotheses stated earlier in the study was as follows:

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[52] Faber Birren, Color Psychology and Color Therapy, (New York, 1950), p. 177.

the order in which colors will be recalled is related to abilities and interests. Data were collected on each of the three groups. In Table VIIIa the tetrachoric correlations between the scores on the Otis Quick-Scoring Mental Ability Test and the order of each of the colors ranked ranged from -.04 to .59. The correlation coefficients between scores on the artistic scale of the Kuder and the order of rank of the colors recalled ranged from -.70 to .68. It may be observed also that a spread of correlation coefficients from -.16 to .59 was found for the relationship between the Recognition of Color Test and the order of ranking of colors recalled, while a range from -.26 to .70 was obtained for the relationship between order of colors ranked and number of colors ranked.

In Tables VIIIb and VIIIc the correlation data showed similar trends. The fluctuations in correlation coefficients probably demonstrated a variation, arising in part, from the small number of cases on which the computations were based. The likelihood of a real relationship existing between order of recall of colors ranked and the other measures is small. Certain of the data indicated high positive or negative associations. These relationships probably occurred by chance. This assumption would have to be retained unless comparable correlations were found on subsequent analyses of similar data obtained from samples possessing like characteristics.

Intercorrelations of Intelligence, Interest, Recognition of Color and Number of Colors Recalled

The fourth hypothesis to be tested was stated as follows: the number of colors recalled by the students is related to abilities and interests. To test this assumption for each of the three groups,

TABLE VIIIa

CORRELATION COEFFICIENTS OF FOUR MEASURES WITH EACH OF ELEVEN COLORS RANKED IN ORDER ON THE BASIS OF RECALL (GROUP I)

	Red	Pink	Green	Turquoise	Gold	Beige	Brown	Yellow	White	Black	Gray
Otis	.19	-.04	.23	.24	.45	.45	.59	---	.26	---	---
Kuder	--	.68	-.67	-.70	.45	.33	-.16	---	.00	---	---
Color Recognition Test	.04	.59	-.16	-.09	.50	---	.50	---	---	---	---
Number Recalled	.05	.11	.56	-.26	.70	.59	.59	---	.26	---	---

--- Tetrachoric correlation coefficients were not obtained in some instances because of a paucity of values in one or more of the four blocks in the correlation tables.

TABLE VIIIb

CORRELATION COEFFICIENTS OF FOUR MEASURES WITH EACH OF TEN COLORS RANKED IN ORDER ON THE BASIS OF RECALL (GROUP II)

	Red	Green	Orange	Beige	Black	Brown	Gold	White	Gray	Metallic
Otis	.36	.04	-.02	-.31	-.05	.45	.28	-.02	---	---
Kuder	.01	-.08	---	.04	.00	.00	.63	.09	---	---
Color Recognition Test	-.24	.05	-.11	.31	.04	.30	.07	.16	---	---
Number Recalled	.03	.00	---	.19	.26	.00	-.01	.00	---	---

--- Tetrachoric correlation coefficients were not obtained in some instances because of a paucity of values in one or more of the four blocks in the correlation tables.

TABLE VIIIc

CORRELATION COEFFICIENTS OF FOUR MEASURES WITH EACH OF EIGHT COLORS RANKED IN ORDER ON THE BASIS OF RECALL (GROUP III)

	Green	Brown	Beige	White	Gray	Yellow	Black	Metallic
Otis	-.08	-.14	.24	.00	-.24	.38	-.24	---
Kuder	-.12	.00	.04	-.04	.11	---	---	---
Color Recognition Test	.29	.26	-.34	-.33	.12	.11	-.29	---
Number Recalled	.09	-.21	.42	.09	---	.00	---	---

--- Tetrachoric correlation coefficients were not obtained in some instances because of a paucity of values in one or more of the four blocks in the correlation tables.

tetrachoric correlation coefficients were determined for the relationship between number of colors ranked on recall and (a) the Otis Quick-Scoring Mental Ability Test (Gamma AM); (b) the artistic scale of the Kuder Preference Record (Form C); and (c) the Recognition of Color Test. The Correlation coefficients are presented in Tables IXa, IXb, and IXc.

It should be noted that in Table IXa the correlations for the data in Group I ranged from .00 between the number ranked on recall and the Recognition of Color test to .41 between the number ranked and level of intelligence. In Table IXb the correlations were higher. The tetrachoric correlations spread from .70 between number ranked and intelligence to .88 between number ranked and interest. In Table IXc the same trend persisted, although the variation in the tetrachoric r's was greater. In this group the degree of association dropped to .23 between number of colors ranked and Recognition of Color Test. The highest relationship was found to be .81 between number ranked and interest.

It appears that the number of colors ranked on recall tended to be related positively to intelligence, interest, and the capacity for recognizing color mixtures of increasing complexity. These outcomes seem to be in line with what might be expected. It would be logical to assume that the number of colors recollected would be dependent to some degree upon intellectual level, degree of artistic interest, capacity to perceive colors, and skill in sensing aesthetic qualities in combinations demanding difficult color discriminations. Despite the small number of cases in each group the results appeared to support these observations. To be certain that the outcomes represented

stable and dependable associations the results would have to hold up on "cross validation". This would entail a replication of the investigation on comparable samples.

Tables IXa, IXb, and IXc present, in addition, the intercorrelations among the measures of intelligence, interest, and recognition of color. In Table IXa the correlations spread from -.45 between the Otis Quick-Scoring Mental Ability Test and the Kuder Preference Record to .45 between the artistic scale and the Recognition of Color Test. In Table IXb the intercorrelations were in a positive direction and tended to be somewhat higher. The relationship was of the order of .49 between Recognition of Color Test and intelligence, while the degree of association between interest and intelligence was as high as .80. This latter value is probably inflated and represents a degree of association which is likely to have occured by chance. In Table IXc the correlation coefficients seemed more in line with what might be expected. The degree of association spread from .19 between the Recognition of Color Test and intelligence to .34 between color recognition and artistic interest.

The intercorrelation coefficients show a certain amount of overlap which is to be expected. It seems logical to assume that the capacity to recognize colors and to perceive fine differences in color interrelationships may be related to level of artistic interest and capacity to deduce and abstract. There is evidence in the literature to show that intelligence and interest are associated. Strong[53] summarized a series of studies showing that correlations ranged from -.40

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[53]E. K. Strong, Jr., Vocational Interests of Men and Women (Stanford, 1943), pp. 332-333.

TABLE IXa

INTERCORRELATIONS OF FOUR VARIABLES
FOR STUDENTS IN GROUP I

	Otis (1)	Kuder (2)	Color Recognition (3)	Number Recalled (4)
1	----	-.45	.41	.41
2			.45	.24
3				.00
4				----

TABLE IXb

INTERCORRELATIONS OF FOUR VARIABLES
FOR STUDENTS IN GROUP II

	Otis (1)	Kuder (2)	Color Recognition (3)	Number Recalled (4)
1	----	.80	.57	.70
2			.49	.88
3				.79
4				----

TABLE IXc

INTERCORRELATIONS OF FOUR VARIABLES
FOR STUDENTS IN GROUP III

	Otis (1)	Kuder (2)	Color Recognition (3)	Number Recalled (4)
1	----	.28	.19	.50
2			.34	.81
3				.23
4				---

to .40, depending on the type of interest. It seemed that the positive correlations were with scientific and linguistic interests, while the negative associations were with social welfare and business detail interests. It is apparent the negative relationship in Table IXa is not reflected in correlations for the same data in the other two tables.

The relationships investigated in the study between intelligence and recognition of color raise more involved questions. It may well be that the ability to make discriminations among complex color associations is related to the capacity for making inferences involving a complex type of "perceptual judgement." This aspect of human behavior is not well understood.

The following section will include summarizations of the outcomes of the study, conclusions, and recommencations for further investigations.

CHAPTER V

SUMMARY AND CONCLUSIONS

In the spring semester of the 1963 school year three groups of students enrolled in the Department of Clothing, Textiles, and Merchandising in the College of Home Economics, Oklahoma State University, consented to participate in the research project. The study was designed to investigate the following hypotheses:

(1) When given the opportunity, students will recall and rank with higher preferences those colors in display areas in the classroom where emphasis is expressed with accent colors.

(2) The drab, conventional colors of the classroom will be given lower preference.

(3) The order in which colors will be recalled is related to interests and abilities.

(4) The number of colors recalled by the students is related to interests and abilities.

The hypotheses stated in (1) and (2) were treated by converting each subject's ranking of colors recalled into "units of amount." This was achieved by assessing the per cent position of each of the subject's color rankings and changing them into values closely approximating the distributions of the normal probability curve. The average of the scores for all subjects in a group were arranged in a final order of

merit. The hypothesis stated in (3) was tested by determining the tetrachoric correlation coefficients between order of colors recalled and (a) intelligence, (b) level of artistic interest, and (c) color recognition. The hypothesis investigated in (4) was tested by computing the realtionships, by means of tetrachoric r, between number of colors recalled and (a) intelligence, (b) level of artistic interest, and (c) color recognition. In addition, in this final analysis, intercorrelation coefficients were computed for the following: (a) intelligence, (b) level of artistic interest, and (c) color recognition.

The findings and the implications of the findings may be summarized briefly:

(1a) The number of colors recalled in Group I ranged from three to eleven. The colors which tended to be most readily recalled were accent colors; these colors received the five top ranks when the final order of merit was determined.

(1b) In Group II the number of colors recalled ranged from three to ten. When the final order of merit for colors recalled was assessed, three of the four accent colors present in the classroom were given ranks in the top half of ranks.

(1c) There were no accent colors in the classroom occupied by Group III. This group tended to give green the highest ranking. This may be due to the fact that green is a universal color; it is extensively experienced by all humans. It is frequently the source of pleasing aesthetic experience.

(2) The drab, conventional colors of the classroom tended to be recalled and ranked lower than the accent colors. This indicates that marked individual differences exist in the way

colors are ranked on recall. Where emphasis is expressed by means of accent colors, they tend to be more generally preferred. There are some individuals, however, who recall and order colors at the top of the list which are drab and lacking in excitement. Although the reasons for such behavior were not explored in this study, factors such as training in the aesthetics of color, practical experience with color arrangements, interest, and temperament probably relate to the ways in which colors are recalled and recorded.

(3) The order in which colors were recalled in each of the three groups was not associated in a consistent way to intelligence, artistic interest, or color recognition. Some of the tetrachoric correlation coefficients ranged from high negative to high positive values. Approximately 40 per cent of the correlation coefficients in Tables VIIIa, VIIIb, and VIIIc were at, or close to, zero. It is likely that the spread of values reflected the operations of chance factors and the small number of cases on which data were available. These factors may have contributed to the variations in outcomes.

(4) The number of colors recalled in all three groups showed, on the whole, positive relationships with intelligence, interest, and recognition of color. It seemed reasonable to assume that level of intelligence was associated with the number of items recollected. In addition, it seemed logical to assume that more effective recall would be associated with interest in context recalled. The capacity to recognize colors of greater complexity has more than moderate association with interest.

Since interest and capacity to recognize color appeared to manifest a certain degree of overlap, both may be presumed to have some influence on the number of colors ranked.

In conclusion, it may be stated that the results obtained in the investigation appeared to support the first, second, and fourth hypotheses. The third hypothesis did not appear to be adequately supported by the data. The correlations secured in attempting to test the third hypothesis showed such wide ranges it was difficult to make a meaningful interpretation of the findings.

Recommendations

It would seem that it might be fruitful to go beyond the confines of the study as it was undertaken. In the investigation questions were raised concerning the relationships of order and number of colors recalled to intelligence, artistic interest, and recognition of color. An extended analysis might include concern with the relationships of order and number to content such as: (a) perceptual span; (b) sex differences; (c) socio-economic level of subjects; and (d) actual skills achieved in areas of artistic endeavor. This appraoch might give a broader insight into the factors related to color preferences and the manner in which these preferences are ordered on recall.

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APPENDIX A

DIRECTIONS TO STUDENTS ON THE RANKING OF COLORS RECALLED

Name_____

Please list below as many of the colors that you can recall as being in the classroom. Rank them in order of preference in terms of the degree to which you have been most aware of them regardless of the size, shape or nature of the object with which the color is associated. The color you have been most aware of and which you recall most readily should be ranked "1" and written down; the next should be ranked "2" and written down and so on. Do this independently of those working around you. You will be given 15 minutes for this procedure. Use the space below.

APPENDIX B-1

RANK ORDER OF COLORS RECALLED FOR EACH STUDENT IN GROUP I

Judge	Red	Pink	Green	Turquoise	Gold	Beige	Brown	Yellow	White	Black	Gray
1	2	4	3	1			5	6			
2	2		1	4		3	6	5			
3			1			3	2		4		
4	1	2	3				4				
5			5	1			4	2	3		6
6			1			3	2	5	6	4	7
7	1	2	5	4	3	7	9	6	10	8	11
8	1	7	4	9	2	5	6			8	3
9	5	6	1	8	7	3	2	9	4	11	10
10	1	2	7	4	3	5	6				
11	2	1		3		5		4			
12	1		2	4	5			3			
13	1		3	2		5	4				
14	1	2	5	3	6			4			
Average	71	58	55	52	48	46	43	42	41	35	30
Final Order of Rank	1	2	3	4	5	6	7	8	9	10	11

APPENDIX B-2

RANK ORDER OF COLORS RECALLED FOR EACH STUDENT IN GROUP II

Judge	Red	Green	Orange	Beige	Black	Brown	Gold	White	Gray	Metallic
1		1		3	5	4	2	7	6	
2	1	2	5	7	4	6	3			
3	1	2		3	6	5			4	
4	1		2	4	5	3	7	6		
5	6	1		2	4	5	7	3		8
6	6	1		3		4	2		5	
7		1				2	3			
8	1	4	5	6	2		3	7	8	
9	1	2	3		5	4				
10	7	1		3	6	4	5	2		
11	1	3		2	4	5		6		7
12	2	1		6	4	3	5	7		
13	1	2		3			5		6	4
14	1	5		6	2	4	3	7	8	
15	1	3				4	2	5	6	
16	3	2			4	1		5		
17	1	2		5	6	3	7	4		8
18	1	2		6	4	3	5	7		
19	1	5			2	3	4	6		
20	4	1		3	6	8	2	5	7	
21	4	1		2	3	6	7	5	8	
22	2	3		7	5	4	1	6		
23	2	1			5	3		4		
24	5	1		2	4	7	6	3		
25	5	6		3	4	7	8	1	2	
26	1	3		6	2	4		5	8	7
27	1	7		4	2	5	6	3		
28	1	3		6	2	7		4	5	
29	5	1		3	6	2	4	7		
30	4	3		1		2	7	5		6
31	2	1			3			4		
32	1	5	2	4	7	3	8	6		
Average	64	63	54	51	47	47	44	39	33	30
Final Order of Ranks	1	2	3	4	5.5	5.5	7	8	9	10

APPENDIX B-3

RANK ORDER OF COLORS RECALLED FOR EACH STUDENT IN GROUP III

Judge	Green	Brown	Beige	White	Gray	Yellow	Black	Metallic
1	1	4	2			3	6	5
2	1	4	2		3	6	5	7
3	1	4	3	2			5	
4	1	3	4	5	2		6	
5	2	3	4	1			6	5
6	4	1	2	6	3		5	
7	2	5	4		5	6	1	
8	2	1					3	
9	5	4	3	1	6		2	
10	3	2	1	6	5	7	4	
11	1	2				4		3
12	2	1		3	4			
13	2	5	1	4	3	6		
14	2	5	1	4	3	6		
15	1	2		5	4		3	
16	2	1	5	4	3			
17	1	2		4	3		5	
18	3	2			4	1		
19	1	4		3	6	5	2	
20	2	1		3	4			
21	1	2		3	4		5	
22	1	6	2	3	5	4	7	
23	4	3	1	2				5
24	2	3	1				5	4
Average	63	59	57	48	41	38	38	34
Final Order of Rank	1	2	3	4	5	6.6	6.7	8

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