Chapter II

Review of Related Studies

2.1 Introduction

The purpose of review of literature is to expand upon the context and background of the study, to help further in defining the problem and provide an empirical basis for the subsequent development of hypothesis. In design education there are no empirical studies done so far. So the researcher had reviewed also books which deal with design and education. The Various studies have been arranged under various heads such as design education, research in education, visual communication and color and form studies, so that they would yield a clear picture of the present scenario in visual communication and color and form studies

2.2 Studies related to design Education

A number of research work and books were gone through to get an insight in the studies done on design education and research on education. In India design education was established after independence .Government of India set up a design institute to train designers. The main idea was to look at design in Indian context, finding linkages between modern design education and traditional Indian design thoughts.

Eames,C.and Eames,R.(1958) in their report on design education (India Report) pointed out the need and purpose of setting up a Design Development and research Institute in India. A case study and the evolution of Indian design in rural context were discussed in the report. This study was in the light of the Government of India's proposal to start a design institute in India after independence. The necessary input to be given in the teaching learning process in the Indian context was highlighted.

Vyas, K. H. (2000) in his book "Design in the Indian context emphasized on learning the historical rationale of the Indian design idiom. It was meant as an aid for those teachers of design who want to generate a sustained dialogue on India's traditional design thoughts and would like to interpret them in terms of modern design theories

2.3 Educational research

While looking at design education it is observed that design education is about theory and practice. So a review is conducted in educational research. The approach in the present study is linked to the aspects of educational research. So the investigator has looked in to some work in educational research to understand various methods in educational research.

David Scott (1996) in his book Understanding Educational Research examines the meaning of 'data' in the context of educational research

and its relationship to theory and practice in education. It focuses on three research strategies and analyses their different ways of understanding data and method; there are different implications of these for theory building and the different relationships they assume between the researcher and the subjects of their research. One of the approaches is the experimental research. The experimental researcher attempts to discover causal relationships between phenomenon by intervening in the natural setting and controlling all the relevant variables. Three approaches have been developed in experimental research in education.

1. Pre-test and post-test design. In the comparison between the two sets of scores on these two tests shows a change for the better on the pre test, it is possible to conclude that the educational intervention has had an effect.

2. Second is a variation of the above; where a control group is added so that comparison can be made between it and the experimental group. Both groups are matched for similar characteristics, and this can be sometimes achieved by random sampling.

3. The third approach is where the researcher accepts that more than one variable many be influential, arguing that a particular variable affects behavior in one context, but not in another. In order to take account of this the researcher studies a number of groups, each of which

has different characteristics, and each of which is subjected to different type of interventions.

These methods are essentially non deductive, and involve the testing of hypothesis. As a result the experimental researchers are able to argue that such methods allow replication, and ultimately lead to the development of general propositions about Educational activities.

In design education a continuous interaction between student and teacher is very important .As the contact time between teacher and student is more, a lot of factors such as motivation, teacher's care, personal relationship, students trust on teachers capabilities and evaluation methods matters a lot on positive teaching learning process.

Zoltan Dornyei (2001) in his book on "motivation" references to leading motivation theories in psychologies.
Socio cultural and contextual influences on behavior and the temporal dimension of motivation are discussed. This book is directly related to motivation and its effects on language studies. But the theories in a general format are applicable to any forms of education. Basically how a teacher interacts with the student and in what all stages the intervention helps etc. are discussed.

Another area of discussion in the book is the notion of de-motivation. It summarizes the most salient factors of de-motivation. Some of the factors of de-motivation are summarized below:

1. Dissatisfaction with grading and assignments;
2. The teacher being boring, bored, unorganized and unprepared;
3. The dislike of the subject area;
4. The inferior organization of teaching material;
5. The teacher being unapproachable, self centered biased, condescending and insulting.

One of the most interesting finding is that the negative teacher behaviors were perceived as central to students de-motivation.

Rebecca Oxford [1998] carried out a content analysis of essays written by approximately 250 American students. The following are the broad data that emerged.

1. The teachers' personal relationship with the students, including a lack of caring, general belligerence, hyper criticism and patronage / favoritism.
2. Teachers' attitude towards the course or the material, including lack of enthusiasm, sloppy management and close mindedness.
3. Style conflicts between teachers and students, including multiple style conflicts, conflicts about the amount of

structure or detail and conflicts about the degree of closure or 'seriousness' of the class.

4. The Nature of the class-room activities, including irrelevance, overload and repetitiveness.

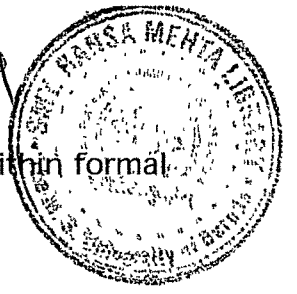
Gary Chambers [1993] studied the characteristics of de-motivation with the help of a questionnaire which was administered to 191 students and seven teachers.

1. Makes no effort to learn, shows no interest, demonstrates poor concentration, produces little or no homework, fails to bring materials to lessons, claims to have lost materials, and does not respond well to extra help.
2. Lacks a belief in own capabilities.
3. Demonstrates lethargy "what is the use"? Syndrome, and gives negative or no response to praise.
4. Is unwilling to co-operate, distracts other pupils, throws things, and shouts out.

And the analysis of the above mentioned characteristics by Gary Chambers brought out some findings regarding the unique characteristics of the motivation to teach. And one of the most important findings is that the teacher motivation affects the motivation of the students.

Julias Sefton(2000)discusses –

1. The function of evaluation in general;



2. The role of formal assessment and its relation within formal evaluation;
3. The role of audience for the creative product;
4. The balance within the subject paid to product and process;
5. The role of reflection and the place of the student's voice.

The studies suggest that motivation, teachers care, evaluation and methods are very important aspect in teaching learning process.

Isadore L – Sonnier's (1982) book is a teacher's guide for scholarly projects from the middle school through graduate school. It helps the teachers with the rationale and encouragement to direct or facilitate a student – centered classroom. In the light of evidence that at least some qualities of individual differences are based on brain lateralization, teaching strategies are offered to meet this wider range of individual differences in a greater variety of classroom settings. This requires a creative approach in teaching learning process.

It is found that it is extremely important to have a creative approach to education which is very well applicable to the context of design education too. But it is equally important to have a structured approach in teaching learning process. So the researcher has looked in to the aspects of opening new paths in the teaching learning process.

Jerome - S. Bruner (1960) has done a searching discussion of school Education. Bruner's book deals in depth with study of opening new paths

in the teaching learning process. Bruner discusses the importance of structure, readiness for learning, intuitive and analytic thinking, motives for learning and aids to teaching.

The first object of any act of learning, over and beyond the pleasure it may give is that it should serve us in the future. Learning should take us somewhere; it should allow us later to go further more easily. The importance of structure is that the curriculum of a subject should be determined by the most fundamental understanding that can be achieved of the underlying principles that gives structure to that subject.

John W. Childs & Frederick G. Kurk (1968) provides a basis for understanding the problems and promises of instructional technology. What emerges from the studies is that it is important to understand a historical context, considering teacher's approach to students' motivation, reliable evaluation systems, and creative and structured course structure.

2.4 Studies related to Visual Communication

Study of color falls in to a broad category of visual communication. Because color is communicated visually only, so in design education study of color comes under visual communication. The researcher had reviewed a large number of books in visual communication to look at the relevance of color and form in design education.

Lester, P. M. (2000) discussed technical and sociological issues relevant to visual communication. And he talked about more sophisticated visual perception techniques on the part of viewers in order to get the most from visual images. Also he has discussed the history of color, physical characteristics of light and color and sociological aspects of color and its meaning.

Arntson, A. E. (1988) introduced the form and function of graphic design to learners who have little background of understanding of its nature. He dealt with design process, history of design and design principles and applied skills in the special areas where visuals in the form of drawing or painting are used as illustration for text and Photography.

Kimbell, R. (1982) gave an account of the history of graphic design. From its roots in the development of printing, graphic design has evolved as a means of identification, information and promotion, to become a profession and discipline in its own right. This book begins with the poster and goes on to chart the development of word and image in brochures and magazines, advertising, corporate identity, television and electronic media, and the effects of technical innovations such as photography and the computer.

Hartt, F. (1985) gave an elaborated study on the history of all visual arts that is painting, sculpture and architecture from prehistoric period to

present. He talked of the development of art as the development of human culture.

Through this book we get an idea of the development of color and its usage, symbolism, cultural meanings and many other developments regarding color.

Suzy [1976] discusses on the development in Contemporary Art. When art of the past is viewed as a part of continuous history, modern abstract art is usually treated as an independent entity that requires whole new systems of reference. In modern art the case of drawing is not simply an extension of ordinary perception, it involves mental reconstructions and comparisons of what has been observed. It is a complex cognitive achievement. And Suzi Gablick discusses about the stages of development in art as three main stages, i.e. Pre-Operational State, Iconic and Symbolic stages. They are Ancient and medieval including Greco – Byzantine ancient oriental, Egyptian, archaic Greek and early medieval time belongs to the pre-operational stage. Iconic mode is Renaissance and symbolic mode is the modern period including late Impressionism, cubism, Formalism, and so on. The history of art begins with the handing down of tradition. Traditions give us something upon which we can operate.

Also he discusses about art as a copy of reality and the relation with original to the copy.

So it was found that in visual communication color and form plays a vital role in establishing the context meaning and symbolic meaning from pre-history to present.

2.5 Studies related to color and form

In order to design a structure for the teaching learning process the researcher has gone through many books on color. There are two major categories in color studies. One is the aesthetic aspect of color that consists of contextual relationship, color theories, color tradition, color and region, color systems, color mixing, harmony and subjective experience of color. And the other aspect is the physics of color; which deals with the optics and other science of color. Also since the color is a result of light a study of light is also covered in this section.

2.5.1 Aesthetic aspects of Color and form

The aesthetic aspect of the color is subjective and contextual. The interrelationship of the colors is known as color interaction which gives aesthetic aspect of the color. The researcher has reviewed many books in this category.

Itten, J. (1930) talked about the Basic principles as well as interesting psychological and optical dimensions of aesthetic perception. It gave a good understanding of color courses which was developed in Bauhaus school. Itten structuralized the color course which was taught in Bauhaus school.

Albers, J. T. (1930) explained the critical contextual relationships of color, how and why colors change their appearance. The book is an elaborate documentation of color interaction, and supports many of the visual aspects which affect the perception of color. The book demonstrates that color perceived is completely dependent on the color it is surrounded by. Same color appears differently in different backgrounds.

Morton, J.L. (1998) gave a practical, visual guide that takes the guesswork out of color theory. This clear, concise, and fully-illustrated book presents a complete picture of color terminology, harmony, and dynamic color effects. 172 illustrations take you from understanding essential theory to application. This is currently being used as a text book for design courses in the US, Canada and Australia.

Morton, J.L. (1998) focuses on color effects in the workplace. The same concepts can be applied to any critical task area. He describes physiological, psychological and optical effects of color and gives formulas for harmonious color schemes. Though this book is dealing with interior spaces and its color combinations, it is applicable for all situations as it falls in the realm of color theories.

Peterson and Cheryl (2000) give a global guide to color and region. The book is organized by continent, region and then country. Color traditions are noted within each country, along with information on the historical significance of many of the color s that are followed today, as well as

anecdotal notes on colors that are taboo or that have given ease to new association in recent years. This information is followed by actual examples of designs culled from design studios the world over, that were created with these associations of color in mind. They have tried to include as many countries and their cultural color differences as possible. Harald (1972) gives a detailed study about different aspects of color through different sections in the book. He tries to look at color as a language and discusses on the correct names of colors; which are generally used and technical names and suggestions from experts.

In the physiological Section Harald put for the assumption that every matter is gray and it is only the effect of light and the way light is absorbed and reflected makes the body colorful. And the process of vision, visual defects, optical illusion, adaptation and simultaneous contrast also comes under physiological section.

The science of light, electro-magnetic waves, light spectrum, emission, reflections and, polarization etc. are discussed in the physical and technical section. In a very systematic way he puts forth the color theory, color mixing and color systems. Basics, like primary color and color circles, complement any colors, additive and subtractive mixture and the possibilities of color modifications are covered in a very systematic way. This book throws light into different color systems like the color cube, Hickelhier's color code, Oswald system, DIN 6164 and a critical assessment of the color systems too incorporated.

He has described about a rhombohedra system in which color saturation, and achromatic colors comes in each plane. Through this system division of colors into groups are much easier and simplified in arrangement. In the conclusion of the book Herald integrates the law of mixtures and discusses the laws of color harmony.

Ostwald (1931) is one of the most important personalities in the field of color. What Ostwald achieved as to color theory and color organization is the substance of this book. Having a broad and philosophical view point he was able to convert a wealth of technical knowledge to artistic ends.

Faber Birren (1969) in his introduction to this book gives a brief account of the history of color systems. Color systems are classification and organization of different types of colors in order to have ease of use in the industry. There are two major color systems that are followed in the industry; they are Muncall system and Ostwald system. And the book is a liberal translation of Wihelm Ostwald's "Die Farbenfibel" Ostwald gives an excellent theoretical demonstration on different types of colors like achromatic colors, chromatic colors, light clear and dark clear colors, muted colors, color solid and the harmony of colors.

In academic field the work of Wilhelm Ostwald has more recognition in Europe than in USA. But in the fine art of painting and paint industry Ostwald has gained increasing acceptance.

Gloag & Mary (1978) through this hand-book describes a method of coordinating the colors and of building materials which is now adopted by British Standard Institution as the basic for all building color standards. Central to the method is a broad framework of colors representative of the whole color gamut and based on attributes of hue, grayness and weight identified by means of Munsell color system. Classification in Munsell's terms has played a key part in the color co-ordination developments, in short: its main features are as follows:

Geometrically it can be represented as a cylindrical solid in which value [lightness] in scaled along with axis from perfect black [value '0'] to perfect white [value '10'] chroma is scaled along the radii from the axis [chroma '0'] outwards to maximum perceptible saturation. Hue is scaled around the circumference in 100 steps divided into 10 bands. Colors are classified by assigning their position on the three scales in the order hue, value and chroma.

This Research for a new framework was concentrated on review of each color attribute in turn, beginning with hue. In the process the researchers maintained contact with a small group of architects and industrial designers in public or private practice with special interest in color.
They have studied the attributes of hue, attributes of grayness and attribute of apparent weight.

After the study they have reached certain conclusions. They are as following,

1. Colors of the same hue are harmonious.
2. Colors one and two steps apart are disharmonious
3. Colors three to five hue steps apart one harmonious.
4. Colors six to ten hue steps are disharmonious.
5. Colors eleven to twenty hue steps apart are harmonious.

Based on the above conclusions, they devised an instrument in 1970 for predicting harmonies and disharmonies from among 40 hues at equal intervals in the re-noted munsell hue scale.

Although the selector was based on propositions which were broadly supported by those of the other authors studied, it was used hot as an arbiter but only as a guide in the selection of hues for the new co-coordinating framework. It proved helpful and its readings have so far been found totally reasonably well with the direct judgments of designers.

Gage (1999) talks about the context of color in which he looks at history of art as a unifying subject. When he discusses about color and culture, Gage is looking at the usage of color systems, color and psychology, chromo therapy and Luscher's test etc. More interesting analysis is done on color in art. He looks into the politics of color, color and gender and how artists have approached color in their usage.

In the second part of the book Gage looks into the relative and absolute aspects of color in history. A systematic analysis of Iconography in the early Middle Ages, color as symbol, and pointillist approach to color are discussed.

A cross cultural study in the ancient America regarding color is also covered in this book. Basic color terms and its problems and color terms and associated products signify the most interesting findings regarding the terminology used in color.

Laura L. Morris (1994) looks at the works of Josef Albers in a new light. All the works reproduced in this book is in originally made with glass. He has understood the value of glass as a permanent medium. This demonstrates Josef Alber's expertise as a colorist and his sensitivity towards light.

Itten (1961) has done a comprehensive study of color and its subjective experience and its objective rationale. Itten has compiled all the experiments done with his students during his teaching time at Bauhaus. Color theory is discussed in detail. Twelve hue color circle and given color contrasts are discussed in details with examples from painting.
Color mixing, color sphere, color harmony and its variations, form and color are very well exemplified through visuals and texts.

Itten has put forth the theory of color impression and the theory of color expression through examples from painters like Seurat and Mondrian.

Composition and its aspects through color give a comprehensive insight towards the elements of composition.

Morton, J.L. (1998) demonstrates the right color to support your message with this visual guide to color symbolism. The symbolic meaning of color has been demonstrated through more than a hundred examples. This gives a good understanding and rationalizes the symbolism in color. Symbolism in color depends on geographical region, culture, socio religious biases and so on. The examples in this book can be taken as a guide to understand the above mentioned aspects to use in applications of color.

It is evident from the review that the study of aesthetic and color is important in design education as majority of visual experience is completely depending on color and form.

2.5.2 Studies related to aspects of Color and Physics

The researcher has looked into the aspects of color and physics as color is an optical phenomena. A selection of books and studies has been reviewed by the researcher to look into the aspects of physics and color. Comparatively new aspects such as digital world also reviewed under this section.

Peterson, L.K.(1998) Illustrates how to choose the right colors for international designs .His work gives an over view of regional and global

aspects which is to be considered in choosing color for designs. So for a designer aiming at a global market this is a good starting. But for an advanced level of application we have to go much beyond this. Still for beginners this is a good reference book.

David K. Lynch & William Livingston (.1995) gives clear explanations to the vast number of naturally occurring optical phenomena seen with the naked eye. It offers complete and easy to understand insights in to shadows, halos, water, optics, mirages and host of other spectacles. It clears many myths about light phenomena. It outlines the basic principles involved. This book gives a good idea about seeing, photographing and understanding natures optical delights.

M. Minnaert (1996) approaches light and color in its scientific manner. This is one of the earliest of its kind. This gives a physical explanation of nature's phenomenon like shadows, reflection, curvature of rays in the atmosphere, intensity and brightness of light, color; after images, contrast, rainbow, haloes, coroner, light and color of the sky and landscape, luminous, plants animals and stones. There are many mathematical formulae which help us to calculate it accurately.

Committee on Colorimetry Optical Society of America (1953)
This report deals with different aspects of color, like, defining the sensations, color attributes, properties of opaque surface color and light as psychophysical analysis of our sensation. Also the art of coloring to the

science of coloring is discussed very well in this book. This book is dealing color as a phenomenon of light. Objects are visible only because light from them enters our eye. Without light nothing can be seen and in particular color cannot be seen apart from light.

R.W. Burnham, R.M. Hanes and C.S. Burleson (1963)in their report to the Inter Society Color Council submitted a statement on the basic principles, of which should be included to any elementary teaching of color.This report explains the concepts of color, definitions of Color. Variations in the normal color responses and color stimulus and about defective color vision.It further discusses the facts of basic color stimulus, colorometry, color discrimination measurement and color names. Also this report gives us an idea about the theoretical aspects like color vision theory, the assessment of color aptitude and experimental color aesthetics. It gives us an idea about the science of color and a scientific approach towards it.

Leo-M. Hurvich (1981), in his book gives a comprehensive examination of color perception in both normal and color defective individuals. It provides a quantitative account of the visual system in relation to its neuro- physiology and photo-chemistry; and describes the experimental research and theory that have contributed to our understanding of the color experience. Appropriate simple demonstrations are provided to show how to compare and modify color appearance.

First, he classifies the visual experience and then brings the relationship between color experience and nervous system. In the science of color he

talks about the spectral Radiations, color appearance and how chromatic and achromatic responses functions and its appearance of spectral lights. In the color mixture area how hue matches additive color mixture and cone photo pigments. Also he discusses the color adaptation, color deficiencies and color specification. As a conclusion, he discusses about reproduction, photography, printing, television and painting.

Minnaert [1954) describes the phenomenon of light in nature. There are many interesting effects in nature created by light. He looks into the science of these phenomena.

Some of the areas of interest are the sunlight and shadows, the nature of the reflection of light, refraction of light, curvature of light rays in the atmosphere and the image of sun getting distorted in different times of the day. Also he deals with the measurement of intensity and brightness of light too.

Minnaert explains the way we see images through eye; the biology and physics of vision; problems in vision and other issues related to seeing an image. Then he comes to color, color mixing in nature, color and landscape, colors of evening and morning, color of sky and light emitting animals and plants etc. He gives practical suggestions for photographing natural phenomena of light from nature.

Bouma [1945] gives a scientific approach to understand the aspects of color. This book reveals the importance of sunlight as the source and how through light how objects appear colored and the role of eye in the color vision. He discusses about three fundamental colors and other physiological significance of the number three. This book goes in depth in brightness, color triangle, color space, C.I.E. systems, colormetry, defective color vision and the historical development of color science. He talks about the pre-Newtonian era, Issac Newton, Johann Wolfgang Von Goethe, Maxwell, and other theories of color vision. The subject goes into the further developments of the experimental side of colorometry, Ostwald's system, Munsell's system and so on. Bouma looks into the practical applications such as applications to trade, industry and science, color reproduction theory additive methods and subtractive methods.

Edward and Thomas [1998] look into the relatively new issues of color in digital world. Till recent times digital color technology was available only on high-end color-imaging systems. He discusses the fundamentals of measurement of colors, color imaging system and humans color imaging systems. Looking into the nature of color images also very important and they looks at video images, reflection images, photographic transparencies and photographic negatives from the point of view of color.

A relatively new aspect is digital color encoding. In this new encoding concepts and its applications are discussed. In the digital world other than

color encoding, digital color management is another major issue. Edward and Thomas talk about a unified color management environment.
These studies points out that the above mentioned aspects are critically important in the color and form studies.

2.6 Implications of the review of related studies for the present study.

The researches that have been reviewed so far confirmed one thing convincingly that the study of color and form is vital in design education. From the review it is evident that most of the studies fall into two categories "historical study" and "practical solutions" for the problems. The researcher could not identify any study related to course development and structuring in color and form studies. In Indian context, the work done is apparently nil; especially in the field of design education.

From the review of related studies the investigator felt that there is a strong need for developing a structured course on color and form studies in Design Education. In order to create a strong base in developing the sensitivity to visual communication in design education, a clear understanding of color and form is necessary. And the color course should have theoretical as well as practical inputs.

In Indian context there is a lack of research studies in design education. There is no evidence of an empirically validated structured course in color

and form and thereby a strong need for developing a course structure to give proper inputs in color and form (both theoretical and practical) as design education is becoming more and more important in the Indian scenario.