PROPOSED LESSONS FOR IMPROVED HOME LIGHTING FOR HOME ECONOMICS EXTENSION PROGRAM IN TAIWAN

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PROPOSED LESSONS FOR IMPROVED HOME LIGHTING

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IN TAIWAN

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PREFACE

This study was designed to secure information about "Better Lighting" programs in the United States that could be utilized by the writer in her program in Taiwan. It is hoped that the findings of this study can be used in the future to strengthen the Home Economics Extension Program as well as to assist other agencies with such a program to raise the standard of living by providing better lighting in the homes in Taiwan.

The writer wishes to express her sincere appreciation and gratitude to the many people who contributed to the completion of this study.

To Dr. Florence McKinney, Head of the Department of Home Management Equipment and Family Economy for her interest, competent guidance and patience through this study.

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Appreciation and gratitude are also extended to the members of American Association of University Women and the United States Education Foundation whose financial support of the fellowship and travel grant

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The writer is indebted to her family members who have given continuous understanding and support through the period of the study. To her husband, F. S.; daughters, Cecilia and Jeanie; and son, Robert, this thesis is dedicated.

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INTRODUCTION

The Background

The Agricultural Extension work in Taiwan is carried out under a three-way agreement among the Provincial Department of Agriculture and Forestry, The Provincial Farmers' Association and the Joint Commission on Rural Reconstruction. Under the agreement, the Provincial Department of Agriculture and Forestry is the sponsoring agency and gives overall guidance, supervision and some financial assistance. The Farmers' Associations at three levels; provincial, hsien (county)/city, and township, are the executing agencies to carry out the extension program. The Joint Commission on Rural Reconstruction as the coordinating agency provides technical assistance and financial support.[1]

Home Economics Extension which started in 1955 with only 30 townships is one phase of the Agricultural Extension program. It was designed to teach the rural women and 4-H club girls to make better use of their resources to solve problems of home making and community life. The specific objectives were to teach them to help themselves through the learning-by-doing process toward improved nutrition, better health and sanitation, improved homes, increased incomes, and better leadership and

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[1] "Agricultural Extension;" Joint Commission on Rural Reconstruction General Report (Taipei, Taiwan, Republic of China, 1961), XII, pp. 22-23.

citizenship.[2]

At the present time there are more than 300 home economics extension workers who are on the farmers' association staff at all levels to carry on the home economics extension program. Most of them are graduates of senior home economics vocational high schools; a few junior college graduates and only a handful with degrees in home economics. In other words, most of the home economics extension workers in Taiwan do not have enough subject matter background for doing the best possible job. In order to make up for this deficiency and to strengthen the home economics program, it is necessary from time to time to furnish the field workers with new information for specific subject matter programs.

During the past ten years, the home economics extension program in Taiwan has helped make many improvements in rural homes. Thousands of farm kitchens have been equipped with sinks, more storage and working spaces, white washed walls and skylights to increase the natural light, and stoves using home generated methane gas and stoves with built-in-coils for hot water supply.[3] All these improvements are stepping stones toward better health, sanitation and improved homes, yet there are still many problems to be solved and improvements to be made, especially in the area of lighting.

The majority of rural homes in Taiwan have access to electricity. Electric power plants, making use of the abundant water power provided by the many streams running down the mountains to the lowland, were first

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[2]"Agricultural Extension and Information," Joint Commission on Rural Construction General Report (Taipei, Taiwan, The Republic of China, 1964), XV, pp. 75-83.

[3]Home Economics Extension in The Republic of China (Taipei, Taiwan, China, Joint Commission on Rural Reconstruction, 1961), pp. 1-20.

installed during the Japanese occupation. The highest capacity was 321,000 kilowatts. After Taiwan was restored to the Chinese Government, steps were taken to repair old plants and to develop new ones, both hydro- and thermal operated. Today there are 37 electric power plants of which 26 are hydraulic and 11 thermal, using locally mined coal.[4]

The total capacity is now around 1,476,000 kilowatts. As a result of a Rural Electrification program, electricity is now available to 97% of the population.[5] The rate level in Taiwan in terms of U.S. dollars is only 1.23 cents per kilowatt hour.[6]

Low cost electricity is available to the people of Taiwan, yet home makers are unaware of what good lighting is and their need of it. It has been a common sight to see a bare bulb covered with dust dangling way up high near the ceiling in the mainroom of many homes. One dim fixture light may serve the entire room in which the housewife is sewing and the children are studying. In many cases, there is a lack of switch or convenience outlets. One outlet may have several wires attached to it with various household appliances such as electric fan, iron, rice cooker, T.V. set, etc,, thus causing a fire hazard. Accidents in the kitchen or storage places may be due to inadequate lighting knowledge, poor quality of light or mishandled electricity. According to a recent government report, the eyesight of Taiwan primary school children is getting worse every year. The study showed nearsighted children increased

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[4] Sales and Service (Taipei, Taiwan, China, Taiwan Power Company, 1965), p. 2.

[5] Ibid.

[6] Ibid., p. 14.

from 33% to 59% within six years.[7] This deplorable condition is due largely to insufficient and improper use of light.

Studies of home lighting are relatively scarce and the resource materials are very limited in Taiwan since there are no home service sections in the power companies or no institutes which sponsor or concern themselves with a home lighting program.

It is clear that the problem of "lighting" in Taiwan is not the availability or the cost of electricity, but lack of an awareness of the importance of light and the information for improving the lighting situation. To correct the poor lighting condition, a better lighting program is an urgent need.

As the home economics leader and specialist in JCRR, the writer has the responsibility to supply information to help people improve the lighting conditions of their homes and to strengthen the Home Economics Extension work as well.

The Purposes

The purpose of this study are defined as follows: (1) to gain up-to-date information on the subject of improved home lighting, so that the investigator may be prepared to assist with the development of this area in the home economics extension program in Taiwan; (2) to develop a program in home lighting that the Agricultural Extention Planning Committee will want to incorporate into the Home Economics Extension program; (3) to provide materials in this new subject matter area to the field workers in such a way as to insure the success of the worker

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[7] Visual Ability of Primary School Children and Illumination (Taiwan, China, Report of Kuo Ming Tang, 1966), p. 23.

in presenting and incorporating the theories and principles in their work with homemakers; (4) to gain specific knowledge to use in selecting fixtures, and lamps so as to use electricity wisely, safely, and with some degree of comfort, beauty and adequacy.

The Procedure

The procedures of this study will be: (1) review library materials to ascertain the latest information related to lighting programs, and determine how it can best be applied to Taiwan rural homes; (2) observe "Better Lighting" programs by visiting Home Service and Sales Departments of Utility Companies such as Oklahoma Public Service Company, Oklahoma Gas and Electric Company, Dallas Power and Light Company, and Texas Public Service Company; (3) discuss with Oklahoma State University Home Management Specialist and State Leader materials and training conferences used with staff and local leaders in related subject areas; (4) discover what printed materials related to home lighting are available from power and utility companies in the United States; and (5) prepare training lessons for home economics extension field workers and suggest illustrative materials incorporating the information gained from this study and show how these can be used in Taiwan with rural people to improve the lighting in their homes.

CHAPTER II

REVIEW OF LITERATURE

History of Lighting

At one time the sun was man's main source of light. Man worked in the daytime and slept during the darkness. Therefore man was almost completely enslaved by nature in his activities.

Fire was the first source of light. Matthew Luckiesh maintained about the flame, "The first primitive being who seized a flaming fagot from the open camp fire and carried it indoors laid the foundation of modern homes."[1] We also know that the ancient Romans used torches for thousands of years. These flames fed upon wood and grass. Then the crude lamp using vegetable oil such as olive or nut oils and animal fats such as lard and tallow replaced the wood. Shell and stone vessels used to hold the burning material were the first lamps.[2] Then about the year 1750 candles, with a wick, were developed from beewax or tallow.

The double-wick whale-oil lamp was used from 1690-1845. An additional transparent glass chimney was placed around the fire in 1784.[3]

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[1]Matthew Luckiesh, Torch of Civilization (New York: G. P. Putman's Sons, 1940), p. 11.

[2]Norma Rownd, "A Study in House Light" (unpub. M.S. thesis, Ohio State University, 1949), p. 2.

[3]William Kunerth, Textbook of Illumination (New York: John Wiley and Sons, Inc., 1929), p. 5.

These inventions and improvements made the light portable and controllable. This kind of lamp gave a cleaner and more brilliant light as well. Clayton produced the first portable coal-gas light and Murdock after many early difficulties invented the piped light-source fixed lamp in 1804.[4] The electric arcs lighting has served only about a century because of the absence of adequate sources and distribution of electrical energy. Luckiesh remarked:

> Such special lighting applications of electric arcs comprise the epilogue of their story in general lighting service. From their debut in electric lighting in about 1875 they served on the streets, in stores, in industrial plants and various large interiors.[5]

Thomas Edison used the first carbonized strip of paper in a poorly evacuated bulb to invent the first incandescent lamp in 1860. After many experiments, in 1879, he gave a practical demonstration of his lamps, operating from his own power-generating lighting system in his laboratory, to light the streets and adjacent houses.[6] This was the first successful incandescent light and the foundation was laid for the use of electricity for lighting.

Importance of Lighting

Light is important. For many years physicists, illuminating engineers, and home economic specialists in lighting have studied and experimented with different ways to find out the lighting problems and to improve home lighting. As Matthew Luckiesh pointed out,

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[4]Luckiesh, Torch of Civilization, pp. 99-100.

[5]Ibid., pp. 114-115.

[6]Ibid., pp. 132-133.

> No explorations have led science further into the universe or deeper into the atom than studies of light. No scientific expeditions have brought back greater additions to knowledge. No applications of knowledge have done more for civilization than the production and use of light. This swift and silent messenger brings to use most of our knowledge in all our pursuits - even the pursuit of light itself.[7]

According to the physicist's explanation, light is a visible radiant energy which comes to us in different wave lengths.[8] It consists of "wave motion."[9]

Without light there is no sight. It is obvious that one who has perfect eyesight can see nothing in a totally darkened room. Van Zant said, "Light is a form of energy which makes vision possible."[10] Light is as essential a factor in our vision as are the eyes themselves.

Eyesight is our most important and educative sense. Our learning process is received through our five senses. The impression percentage of them are: ear, 7%; touch, 2.5%; nose, 3.5%; taste, 1%; and eye, 87%. Thus, over eighty percent of one's knowledge is brought through the eyes.[11] Luckiesh too maintained that a high percentage of all stimuli to the brain come through the eyes. This means that our usefulness, welfare and happiness depend largely upon our ability to see.

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[7]Ibid., p. 46.

[8]H. Hewitt and A. S. Vause, Lamp and Lighting (New York: American Elsevier Publishing Company, Inc., 1966), p. 1.

[9]Lester T. Earls, A Brief Course in Physics (New York: Prentice Hall, Inc., 1949), p. 265.

[10]Helen J. Van Zante, Household Equipment Principles (New York: Prentice Hall, Inc., 1964), p. 81.

[11]Myrtle Fahsbender, Residential Lighting (New York: D. Van Nostrand, Inc., 1947), p. 119.

Most of us are born with perfect eyesight, but during our life time many of us will have to wear glasses. Eye strain is one of the major causes of today's eye problems. Luckiesh stated,

> Nearly all of them (new born babies) will retain their so-called normal eyesight until after they start to school. As these school-children progress from grade to grade, the percentage of them whose eyes become measurabely defective steadily increase. When they graduate from high school about one out of four will need eye-glasses. When they graduate from college one out of three will need eye-glasses. When they reach middle age about one out of two will need eye-glasses.[12]

Our eyes change with age. According to research, visual acuity is reduced by approximately 50 percent between the ages of 20 and 80.[13] At least half of the people past fifty years of age have defective vision as the pupils of the eye gradually become smaller. Because of this prevelence of defective vision, it is estimated that old people require twice as much light in order to see as well as young people. Although age changes the eyes, older people can be helped to see better by giving them increased quantity and better quality of light which they need for seeing.

Research has found that seeing under poor light not only affects eyes but the entire body. Kraehenbuehl noticed "the detrimental effects upon the whole system if the sight is defective."[14] Seeing is work just like walking, climbing or running is work. Seeing requires accurate

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[12]Luckiesh, Torch of Civilization, pp. 205-206.

[13]C. L. Crouch, "Older Eyes Have Special Needs," Better Light Better Sight News, Jan.-Feb., 1965, pp. 10-13.

[14]John O. Kraehenbuehl, Electrical Illumination (New York: John Wiley & Sons, Inc., 1942), p. 45.

focusing of the eyes and the attention too. Holway said visual fatigue could be lessened when the amount of light is increased.[15]

Due to the limitation of our sight and tasks which are fixed, the only way to correct the defects is by controlling the lighting situation. Luckiesh made a test upon a group of persons and found the importance of adequate light as well as of proper eyeglasses.[16] By no means is it implied that more light is a substitute for eyeglasses. Eyeglasses are needed to correct optical defects and relieve eye strain. More light increases the ability of the eyes to see without strain or decreases the limitations of vision.

Better light provides a greater appreciation of color and texture, for better light emphasizes these and people can see the differences more easily. Commery and Stephenson indicated:

> Color is light and light is color... Light produces color, when properly balanced, light and color intensify each other and are more effective than each alone. Light changes the colors and the appearance of your home.[17]

At night, light can make homes look more cheerful and furnishings more attractive; more like they appear during the day time when rooms are filled with sun light. Better light can bring an added decorative beauty to a home. It will make any room warm and glowing with the friendly, comfortable atmosphere so desirable in decoration. Luckiesh

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[15]Alfred H. Holway and Dorthy Jameson, Good Lighting for People at Work in Reading Rooms and Offices (Division of Research, Graduate School of Business Administration, Harvard University, Boston, Massachusetts), p. 4.

[16]Luckiesh, Torch of Civilization, p. 210.

[17]E. W. Commery and Eugene E. Stepheson, How to Decorate and Light Your Home (New York: Coward-McCann, Inc., 1955), pp. 25-36.

indicated:

> It is a new art of lighting....It rarely occurs to him to analyze the lighting effect - the influence of light on the appearance or the expression or the mood of the room. Our interest in light is changing from merely admiration of and interest in light sources and lighting fixture to that of artists interested in material-light - as a medium of expression. We are beginning to paint and to model with light.[18]

Light can make rooms seem larger, thus valuable space may be more fully utilized. Improved lighting may offer a better way of living and of enjoying a home.

Better light means greater safety too. The Safety Council reports show that falls are the cause of more than half of all fatal home accidents, which kill 14,500 persons annually. Poor lighting in stairways, halls, and especially bedrooms and kitchens, where most accidents occur, is the the main cause of such falls.[19]

Thieves, vandals, prowlers are known to avoid well lighted areas. Law enforcement agencies reported a 71% decrease in total crimes, and those of personal violence decreased by almost half when street lights were installed in the five most crime-ridden areas in New York City.[20] Steps, walks, drives, or any outdoor area are safer for the family and guests when properly lighted.

Every home recognizes the need for light but too few people take

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[18]Matthew Luckiesh, Lighting Fixture and Lighting Effects (New York: McGraw-Hill Book Company, Inc., 1953), p. 8.

[19]Ruth W. Putman, Light in Your Home (University of North Carolina, Greensboro, North Carolina, 1962), p. 6.

[20]Light...Your Secret to Security (Large Lamp Department, General Electric).

advantage of the benefits of good lighting. With a little knowledge and planning, proper lighting pays dividends of beauty, comfort, and good vision.

Aspects of Visual Tasks

There are three essential elements involved in seeing: the eyes, the task, and the light. In discussing lighting, visual task is the term used for the sum total of all the things that must be seen at a given moment. This visual task is constantly changing. The eyes and accuracy with which we see depends upon five factors: brightness, contrast, size, time, and color.

Brightness. This is a primary factor of a visual task. Brightness depends upon how much light the object emits, such as an electric light bulb; or the light it reflects, such as a highly polished table top; or the light it transmits, as in the case of the translucent shade around the bulb.

Reflection of light occurs in most visual tasks except those which give off their own light. Brightness depends on the amount of light that falls upon an object and the ability of the object to reflect the light. With a given amount of illumination and a neutral background, we find it easier to see light-colored objects than dark-colored ones because more light is reflected by the light-colored ones. Surfaces with low reflectance can be seen under high levels of illumination to give them the same visibility as surfaces with high reflectances. Therefore dark gray requires a higher level of illumination than light gray, if both are to be equally visible.

Contrast. This factor relates the object to its immediate background. The greater the contrast, the more easily a visual task may be performed under a given level of brightness. Since white reflects all light and black reflects none, the highest contrast in brightness is found in such combinations as black print on white paper. In general, poor contrast requires more illumination than do similar tasks with greater contrast.

Size. This is also important in visual task. In the same amount of light and with the same background, the bigger object can be seen more easily than the smaller one. This is why we can see a tennis ball better than a ping-pong ball if each are at the same distance and against the same background.

Time. This is another factor to be considered in visual task. The longer the time provided to see, the better and more detailed the seeing task can be done. Thus a falling baseball is more difficult to see than a stationary ping-pong ball, although the baseball is much larger. Similarly, a person in a swiftly moving train sees only a blur when he looks out at objects on the ground near the train because he moves away too fast and has too little time.

Color. This fifth factor is related to both contrast and brightness.

Brightness, contrast, size, and time are all related; an increase in any one of them will compensate for deficiencies among the other three factors.

Unfortunately we cannot always choose what we would like to change when we have difficulty in visual tasks. However, usually we can change the brightness by controlling the amount of light falling on the object.

This is the way we help ourselves to doing a better job with visual tasks. We can feel more comfortable and enjoy our life better too.

Lighting Problems

Light, like any other physical quantity, is measurable. As length, heat, and volume are measured, the quantity of light on a surface is measured in units called foot-candles. A foot-candle is the amount of light falling on a surface that is at all points one foot away from a standard candle (about three-fourth inches in diameter).[21] Lightmeters of various sizes and types are used to measure this quantity of light.

The lighting level is greatly affected by distance. The intensity of illumination on a surface follows the inverse-square law.[22] This means the light decreases, not in direct additive proportion but it decreases inversely as the square of the distance between the source and the surface. Thus as one moves away from the source of light, the amount reduces by the square of the distance. If one receives 36 units of light one foot away from the light source, when two feet away from the light source, one would only receive nine units. At three times the distance, the illumination would be one ninth or only four foot-candles. So the amount of light decreases rapidly as one moves away from the source of light.

In order to help families have more use of room space, more beauty in the home, and greater safety and comfort in home tasks, we have to consider some of the essential factors that cause our lighting problems.

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[21] Luckiesh, Torch of Civilization, p. 54.

[22] W. Seagers, Light, Vision and Learning (New York: Better Light Better Sight Bureau, 1965), p. 45.

Quantity of Light. People always wonder how much light is enough for different visual tasks. There is no one answer to the question of the proper amount of illumination in the home, because so many elements are involved. However, research and experience have resulted in the development of some recommendations for home lighting by The Illuminating Engineering Society (Table I).

In addition to these recommendations for specific visual tasks, general room lighting is essential to have comfortable seeing conditions. The I.E.S. recommends the following levels of general lighting: Entrances, hallways, stairways, and stair-landings, 10 ft.-c; living room, dining room, bedroom, family room, sun-room, library, game or recreation room, 10 ft.-c; kitchen, laundry, bathroom, 30 ft.-c.

These recommendations, reported by the I.E.S. are concerned with the lowest level of illumination at which seeing is easy, accurate, and comfortable. These recommended amounts of footcandles can be achieved by a combination of general and supplementary lighting, but the general lighting should be not less than 20 footcandles and should contribute at least one-tenth of the total amount of illumination on the task.

Quality of Light. In addition to a sufficient amount of light, the proper quality of light is essential for seeing too. The quality factors are many and complex too. Glare, brightness differences, diffusion and color are considered the most influential in quality of light.

(1) Glare: Light in the wrong place is raw, irritating light. It either reaches the eye directly from the light source or is reflected to the eye from some object within the field of view. In other words, glare occurs when brightness becomes an annoyance and causes discomfort,

TABLE I

RESIDENTIAL LIGHTING RECOMMENDATIONS[23]

	Visual Task	Minimum Foot-candles on task at any time	
Reading and writing	Books, magazines, newspaper	30	fo-c
	Handwriting, reproduction and poor copies	70	
	Music scores, simple	30	
	Music scores, advanced	70	
Study desks		70	
Sewing	Dark fabric (fine detailed, low contrast)	200	
	Prolong periods (light to medium fabrics)	100	
	Occasional (coarse thread, large stitches high contrast of thread to fabric)	30	
Kitchen activities	At the sink	70	
	At the range	50	
	At the work counters	50	
Laundry duties	At washer	50	
	At ironing board	50	
	At ironer	50	
Grooming	Shaving, makeup, grooming; on the face at mirror locations	50	
Table games	Such as a card table, table tennis	30	
Handcraft	Rough sawing and benchwork	30	
	Sizing, planing, rough sanding, glueing, veneering, medium quality benchwork	50	
	Fine benchwork, fine sanding and finishing	100	

interference with vision, or eye fatigue.[24]

Glare may be classified into direct glare and reflected glare.

[23] IES Lighting Handbook, Third Edition, 1959, pp. 9-81, 9-82.

[24] Kraehenbuehl, Ibid., p. 49.

Direct glare is caused by light from high brightness light sources in the field of view such as a bare light bulb. For this reason, light sources should be shaded or shielded so that the eyes do not receive light directly from a bright source. Reflected glare is caused by the reflection of high brightness light sources from glossy surface within the field of view such as slick white paper. According to John O. Kredhenbuehl, glare may be caused by the following factors:[25]

(a) high brightness of the source;

(b) high contrast between source and background;

(c) location of source in the field of views;

(d) total volume of light entering the eye;

(e) time of exposure to the light source.

(2) Brightness Difference: This means the same level of illumination falls on surfaces of different reflectances, or two or more surfaces in the surroundings and within the field of view receive different amounts of illumination. Some brightness differences within the field of view are desirable to prevent monotony, but precautions should be taken to insure against sharp contrasts in brightness between visual task and its immediate surroundings.

Brightness ratio is the ratio of the brightness of any two surfaces, and when these surfaces are adjacent, the brightness ratio is commonly called the brightness contrast. The desirable value of this ratio is variously stated as 10 to 1 and 20 to 1, with the more recent study limiting the value to 3 to 1 in the field vision.[26]

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[25] Ibid., p. 50.

[26] Ibid.

Comfortable brightness difference can be obtained by a careful balancing of all factors involved including not only the light sources but windows and luminaires and also the reflectance of the ceiling, walls, floor and furnishings and careful consideration of the characteristic of the visual task and its immediate surroundings. In order to achieve the desired brightness ratio, room decoration must be considered as a part of the lighting plan. White or pale-tinted ceilings should range in reflectance from 60 to 85 percent; 70 percent or more is required for effective performance of indirect lighting methods. Walls hould have a reflectance of 35 to 60 percent, although more than 50 percent reflectance creates problems when portable luminaires are placed close to walls or when extensive wall lighting is used. The reflectance range for floor is 15 to 35 percent, but 25 to 35 percent is preferred.[27]

(3) Diffusion of light: This is to break the light and make it come from many directions, rather than one direction. Diffusion makes the light source spread over a large area. Well diffused light produces practically no visual shadows. Since it is usually desirable to reduce brightness difference between shadows and other parts of the visual field diffused lighting is generally desired. Diffusion may be achieved by using large area low-brightness luminaires, by providing indirect or partially indirect lighting in which the ceiling and walls become secondary sources of light, and light colored matte finishes on ceilings, walls, furniture, and floor.

(4) Color: This is the fourth quality factor of illumination to be discussed. While it is true that the color of light appears to have

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[27]Teaching About Light and Sight, (Washington D.C.: National Education Association, 1964), p. 29.

little effect upon visual performance, the psychological effects of the color of illumination are very important. The color of the light has a very definite effect upon the appearance of surroundings and upon the appearance of the complexions of persons. For this reason, in most areas in which persons work at a variety of tasks the best light source is one which produces a range of colors approximating daylight. In order to insure the harmony and effectiveness of a decorative scheme, it is desirable that the selection of tint colors, furniture, and other items be made after viewing them under the intensity and types of light in which they will be used.

Modern Lighting Sources

The most common residential electric lighting sources in use now are the incandescent bulbs and fluorescent tubes. One who works with lighting problems must understand the differences between these two light sources.

Incandescent Bulbs.[28] This bulb is sometimes called the "electric bulb." The word "incandescent" means "white glow, or luminous, with intense heat." It involves a filament, or tiny coil of very fine wire in a glass bulb. The coil is heated as the electric current passes through and the wire gives off light. Generally vacuum globes were used in order not only to prevent the oxidation of the filament, but also to prevent the loss of heat which would reduce the bulbs' efficiency. But nowadays electric bulbs contain an inert gas to give gas pressure which reduces

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[28] Light Bulbs and Fluorescent Tubes, A Reference Guide for the Home, Lamp Division, Home Lighting Department, Westinghouse Electric Corporation, New Jersey, S-421.

the rate of evaporation of the filament. Eighty to 90 percent of argon gas with a small percent of nitrogen is used for this purpose. Tungsten has replaced the carbon filament after difficulties in its use were overcome.

Modern technology has developed incandescent lamps providing high lighting levels over relatively long periods of time. In the early stages light bulbs were made of clear glass. In order to have better diffused light and make the task easier to do and the light more comfortable, the bulbs were treated with different finishes. One finish is to use a kind of acid inside of the bulb to etch it and make it a little rough on the inside. A second way is to coat the inside with fine white silica particles. Both of the ways eliminate the bright spot near the filament and diffuse the light over a larger area. Some bulbs are treated with different delicate pastel colors which provide some diffusion and softness of illumination. The silver coated bulb is a standard inside frosted bulb with silver on the bowl end of the bulb. It is designed primarily for use in the base-up fixture. The purpose of the opaque silver coating is to direct all the light upward against the ceiling or the reflector, and at the same time to conceal the brightness or the bowl end of the bulb.

Since incandescent bulbs are brilliant and are virtually a point source of light, they must be shaded for eye comfort. The bulbs are inexpensive and easy to operate, and they give light instantaneously. Under the incandescent lighting, yellow and red colors are intensified; blues and violets are grayed. The incandescent bulb gives off a large proportion of its heat output. This may reduce the efficiency of an air conditioning system or be an annoyance when placed close to a person at

work, especially in the summer time.[29]

Fluorescent Tubes. This is a kind of long narrow tube lighted through the phenomenon of fluorescence. Fluorescence is the property of a material to become self-luminous when acted upon by radiant energy, such as ultraviolet or X-rays. Two essential elements are required in a fluorescent tube. One is a radiant energy while the other is a fluorescent. The fluorescent tubes are usually long glass bulbs coated with one or more fluorescent chemicals called "phosphors". Electrodes are sealed into each end of the tube from which the air has been removed and a small amount of mercury inserted. When an electric current passes through the electrodes the mercury gas emits invisible short ultraviolet light and the phosphor coating converts the ultraviolet light into white light.

The fluorescent tubes give blue, blue-white, green, orange, yellow and pink shades of light. They can be controlled by mixing different proportions of gas to produce different shades of light.

Fluorescent tubes provide three to four times as much light per watt of electricity as incandescent lamps resulting in less heat produced. They will operate about seven to 10 times longer than incandescent light bulbs before replacement is required.[30]

There are installation problems in the use of fluorescent lighting. That is the unit must include a mechanism called the ballast, which is necessary to control the output of electric current. Unless the unit is

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[29]Teaching About Light and Sight, p. 19.

[30]Light Bulbs and Fluorescent Tubes, p. 12.

carefully mounted, the ballast may produce a humming sound.[31]

Another problem is that wattages cannot be as readily changed in fluorescent lighting as they can be in incandescent lighting, because of the necessity of using different ballasts. The cost for installing the fluorescent lighting fixture is greater than for the lighting fixture using an incandescent bulb, but the cost of operation is much lower.

Lighting Equipment

Good lighting is to have the right kind of light in the proper place so that people can see easily and comfortably. Each activity in the home has its own specific lighting requirement. Lighting can be classified into general, local and accent lighting. These three kinds of lighting can be provided by ceiling fixture, structural and portable types. Every room should have two of the three kinds of lighting - general and local lighting. The third kind, accent, may also be used but is not necessary in every room of a home.

General light is a moderate level of soft, overall background light throughout the entire room. This kind of light is usually the over head source supplied by ceiling fixtures or the structural type of fixtures attached to walls. All general light aids in the performance of tasks by supplementing the local light. It minimizes the contrast of the table lamps or other local light sources, which might seem objectionably bright otherwise. General light makes the room look larger and makes it possible to use all the available space.

In the public or social area of a house local light or task light

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[31] Teaching About Light and Sight, p. 20.

is most often provided by a floor or table lamp. In the working areas, task light is the light source closest to the work. It is frequently less diffused than general light, but this is not always the case.

Accent or decorative light is to attain artistry in lighting effects or to enhance the beauty in form, color, texture or line of structual elements, plantings, sculpture, paintings and other art objects. In this field lighting is an art as well as a science.

Ceiling-Fixture. This is the light fixture attached to a ceiling and gives downward light. They are in three categories.

(1) Recess light gives a more spacious uncluttered look, especially where ceilings are low. Because of the reduced efficiency of recessed units, it is usually necessary to use twice as many recessed units as surface-mounted ones. Recessed units need diffusing glass, plastic, or louver shielding to distribute the light as widely as possible.

(2) Flush light or surface light or surface-mounted light is surface mounted next to the ceiling and it is the most economical and efficient for general lighting. Fixtures should be selected that give a wide spread of light throughout the room and not just downward. This unit should be generously scaled because the larger the fixture the less brightness contrast there will be.

(3) Hanging light or pendant type is the light recommended to be spaced by distance not to exceed the ceiling height. It is suggested that units should have at least six feet and six inches clearance below them. The style of fixture should harmonize with home decoration, but each fixture should be sheilded to provide well-distributed and glare-free light. It should provide both upward and downward light.

Structural Lighting. This lighting form is usually built in as part of the structure or uses structural elements such as the joist space as a part of the unit luminaire. They can be classified as cornice, valance, wall bracket and cove.

(1) Cornice light is the light attached to the ceiling above any wall area. It is good for a low-ceilinged room. The faceboard should be a minimum of 6 inches in width, and extend out a minimum 6 inches from the wall. The channel is mounted on the ceiling, with the center of the tube a minimum of 4 inches from the wall (see Appendix A). Since cornice lighting sends all of the light downward, it is desirable to supplement cornice lighting with upward lighting from either open top portable lamps, a fixture, valance or wall bracket.

(2) Valance lighting is used over window and draperies and supplies both upward and downward light. A minimum distance of 10-12 inches from the ceiling to the top of the faceboard is required. The faceboard should be a minimum of six inches in width, and extend out a minimum of six inches from the wall. The channel is mounted on the wall and blocked out so that the center of the tube is a minimum of four inches from the wall, and from the top of the faceboard (see Appendix B). Valance should extend a minimum of 6-12 inches on either side of the window to allow for the draperies to pull back. Draperies should be light in color.

(3) Wall-bracket lighting is especially good for definite needs of utility and decoration such as over pictures or wall murals. It gives both upward and downward light. This is the same as valance except it is used on an interior wall and not related to the window. The faceboard should be a minimum of six inches in width, and extend out a minimum of six inches from the wall. Since draperies are not used under

wall brackets, the channel is mounted on the wall and blocked out so that the center of the tube is a minimum three inches from the wall. For general lighting the bottom of the faceboard should be at least 65 inches from the floor. Exceptions occur when the units are mounted at the same height as the valance used in the same room. Low wall brackets are used for local lighting and its length should be related to nearby furniture groupings or to the task as the bed, desk and range (see Appendix C).

(4) Cove lighting directs all light to the ceiling. It should be used only with white or near-white ceilings. Cove lighting is soft and uniform but lacks interest or emphasis. It is best used to supplement other lighting. It is suitable for high-ceilinged rooms and for places where the structural design has been planned to give a feeling of height and spaciousness. The conventional cove is a trough-shaped architectural element usually on the upper wall of a room. The top of the light source should be at least 12 inches below the ceiling. Increasing this minimum distance will improve the distribution of light across the ceiling and throughout the room. The center of the light source should be located at least 4½ inches from the wall to prevent excessive wall brightness. The position of the cove in the room, the position of the light sources in the cove, and the dimensions of the cove itself should be carefully coordinated (see Appendix D).

Portable Lamps. Portable lamps contribute interest qualities to an interior that no other decorative medium can provide and in addition lighting at almost any single desired location. They are flexible in arrangement, and easy to move from one place to another. In selection of a portable lamp, some quality features should be noticed.

(1) Under the shade diffusors, reflectors and refractors: If the lighting in a room is well balanced and the room has favorable reflections, there is no need for each portable lamp to have light control devices under the shade; the ordinary inside frosted or white bulb will be adequate.

(2) Light source positioning: A lamp is to provide more light for the task. The present practice in lamp design is to center the light source so that shade brightness appears uniform. A better solution would be to mount one bulb high in the shade to provide upward light, while the bulbs actually needed for reading or sewing or what ever the tasks are located close to the bottom edge of the shade.

(3) Shade - size, color and translucency: Extra deep, narrow shades provide circles of light that are too confined for reading in a comfortable position. In selecting lamp shades for a room, a more pleasing effect is achieved when the shadow blends smoothly rather than contrasts sharply with their back ground, both as to color and brightness. Semi-translucent shades provide attractive horizontal or crosslighting in a room; and if all shades have the same general brightness appearance, the effect is more harmonious.

Table lamps with shade measuring 16 inches or greater, across the bottom will allow a spread of light which will cover the reading surface. Table lamps intended for use on tables should be of such a size that when the table height is added to the lamp base height (from the bottom of the base to the bottom of the shade), the sum equals the eye level of the seated person. With conventional type upholstered furnishings the eye height is generally 38-42 inches from the floor. Thus, an average height from the floor to the bottom of the shade is 40 inches. Floor

lamps are usually 47 inches for junior and 49 inches for senior in height and 16-18 inches in diameter across the bottom of the shade. In other words the bottom of the shade should be at the readers' eye level. Wall lamps generally have a shade diameter ranging from 12-16 inches. The smaller size is often used in pairs over a study desk or double bed.

(4) Lamp placement: A well designed lamp can only perform effectively if it is placed in correct relation to the task. There must be a very definite correlation between the height of the lamp to the bottom of the shade, the height of the table on which it is placed, and the distance between the lamp and the task (see Appendix E).

CHAPTER III

PROPOSED LESSON GUIDES

Recognition of Problems

After a careful study and considered analysis of lighting references, it has been found that there are several lighting problems which need to be solved for the betterment of the people in Taiwan. The problems relate to the following:

Low Level of Illumination. It has been noticed that school children's visual ability has decreased greatly. From a recent survey made by Kuo Ming Tang, using a random sampling method in schools and homes, it was found that the home illumination of 92 familes in four rural townships was far below the standard. The highest illumination was 150 Lux and the lowest was 5 Lux.[1] (one foot-candle corresponds roughly to ten Lux).[2] In other words, the highest home illumination was 15 foot-candles and the lowest was only one-half a foot-candle. According to the IES standard, the lighting level for reading books, magazines, and newspapers is 30 footcandles, for hand writing it is 70 footcandles and for hallways,

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[1]The Relation Between Visibility of Elementary School Children and Illumination (Taiwan, Report of Kuo Ming Tang, 1967), p. 1.

[2]Frank C. Caldwell, Modern Lighting (New York: The Macmillan Company, 1930), p. 2.

bedroom and general lighting it is 10 footcandles.[3] Thus it is obvious that the low level of illumination is a serious problem in Taiwan. Because of this low level of illumination, seeing conditions are neither comfortable, nor pleasant, and school children's visual acuity is affected.

Poor Quality of Light. The writer has been working in rural areas of Taiwan for about ten years. From her observation in rural homes, she has found that most rural families do not realize the importance of the lighting situation; how it affects the eyes, health and enjoyment of life. It is very common to see a drop cord-bare bulb hanging suspended from the ceiling in a corner of a room, or sometimes, even two rooms share the one bulb and move it around to the place where and when it is needed. Most families use the clear bulbs because they think they get more light from these bulbs than from the inside frosted ones.

The bare ceiling bulb provides the room a very bright spot and some very dark areas. Too much brightness contrast, too strong a glare, and no diffusion to soften the light source create irritating and annoying situations causing people to tire easily, to see the task inaccurately, and sometimes may be the cause of accidents.

Uneconomical Use of Light and Electricity. In many cases rural people use poorly designed lamps and lamp shades which cannot produce and distribute the kind of light needed. The incorrect position of portable lamps is another factor in the waste of light. Many lighting fixtures are covered with dust, dirt or grease. Many too are without any shades.

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[3]IES Lighting Handbook (Third Edition, 1959), pp. 9-81, 9-82.

Studies have demonstrated that the dust, dirt and grease reduce light efficiency as much as 40 percent. The lighting fixture without a shade means the light from the bulb cannot be reflected and directed sufficiently by the shade to the working surface. Thus, people waste their money for they do not utilize fully the electricity for which they have paid.

These problems occur in Taiwan rural homes due to a lack of information on the part of the homemaker, and their choice of inadequately designed lighting fixtures and lamps from the market.

The detection and correction of such defects are the responsibility of those who are concerned with benefiting people. Since the Home Economics Extension field workers are the persons who work in the rural areas to teach homemakers how to improve their homes, this is a good chance for them to carry out this project of improving the lighting situations in the homes of Taiwan.

Suggested Goals and Plans

Having identified some of the lighting problems of Taiwan rural families, a better lighting program to improve the home lighting situation is definitely needed. The program herein proposed would strive to help families achieve the following goals:

(1) supply enough illumination for general lighting in their rooms and homes;

(2) have local task lighting in addition to general lighting to meet the needs for reading, sewing, cooking and those other seeing tasks important to a specific family;

(3) improve the quality of light by providing proper shades,

correct positions and heights, and suitable surroundings free from glare, brightness contrast, and harsh shadows;

(4) know how to select good lighting fixtures, portable lamps and good lamp shades for various purposes;

(5) know how to use and keep the lighting equipment in good shape and condition.

It is hoped these goals will be achieved through the home economics field workers program with the rural homemakers.

The procedure for the program to arrive at these goals shall take the following steps:

(1) Since the Joint Commission on Rural Reconstruction (JCRR) is the leading agency in promoting rural development, it has the responsibility to take the initiative for organizing an advisory committee for a better lighting program. This committee would include related and influential agencies such as Ministry of Education, Ministry of Economics, Provincial Health Department, Provincial Department of Agriculture and Forestry, Taiwan Power Company, Provincial Farmers' Association and some lighting supply manufacturers. This committee would serve in program planning, budgeting, supervising and evaluating.

(2) The better lighting program will be carried through the Farmers' Association, the executing agencies, as a part of the home improvement project of the Home Economics Extension Program, under the overall supervision and with some financial assistance of the Provincial Department of Agriculture and Forestry and under the technical and financial assistance of the Joint Commission on Rural Reconstruction.

(3) J.C.R.R. would be asked to supply the budget, latest lighting information, training technics, handout materials, and leaders training

guides. They would work with the Provincial Farmers' Association, P.D. A.F., and other agencies to train the home economics extension field workers.

(4) The Credit Service Section of Farmers' Association would be encouraged to set up a "Better Lighting Program Loan" to the families for their improvement of lighting situation just as the Section now supplies the farmers with other funds for production purposes and such needs as fertilizer or seed loans.

(5) The home economics extension field workers would use the knowledge gained from the training lesson guide with the home extension leaders in their communities. These leaders, in turn, would contact their adult and 4-H Club members through regular monthly meetings. During these meetings, the leaders using the training lesson guides to pass along the lighting information, initiate action to improve lighting in Taiwan rural homes.

(6) An evaluation form would be used several months after initiating the program to measure how effective it has been in improving home lighting and to work out a suggestion for a further improvement plan to be used in the future.

Seven Training Lessons for Field Workers

The intention of this writer is to develop a series of training lesson guides to use in a better lighting program. It would be presented to the home economics extension field workers so that they might disseminate the lighting subject matter as they train their leaders in local meetings in the rural areas. This useful and practical disseminating job is not easy, especially for those workers who do not have enough

background and teaching experiences. Therefore, this training guide is necessary.

The writer would translate the lesson materials into Chinese. Based on the literature reviewed, she might also develop a set of leaflets, bulletins, flip charts, or other supporting materials as well as some audio visual aids such as slides and film strips to facilitate the teaching program when she goes back home.

Under each lesson guide, the purpose, the equipment needed, and specific activities or demonstrations are carefully explained. The lesson guides are the discussion clues given for the main points of the teaching. These were worked out to remind and instruct the home economics extension workers in what they need for the lighting program and in how to interpret this new information to the rural women and 4-H Club members.

Suggestions for several demonstrations are given in each lesson. The home economics extension worker may decide to omit some of them; however, participation and demonstration give better learning results.

Furthermore, it is good teaching practice to have some home work such as a check list in order to have a chance to rethink the principles learned in the lesson. The one who gives the demonstration reitterates its purposes and asks members questions to stimulate their thinking. At the beginning of each meeting time, the previous lesson is reviewed and the home assignments or problems discussed as a group. Time for discussion and for the members to ask questions is provided at the end of each demonstration.

Lesson Guide One - The Importance of Light

Purposes.

(1) To learn the importance of the element of light in seeing tasks.

(2) To understand how light helps us see better.

(3) To learn various activity needs for different levels of light.

(4) To appreciate the special needs for light by older aged persons.

Demonstrations.

(1) In a rather dim class room, as soon as you get on the platform, have someone turn off the light and let the class sit in the dark for several minutes. You ask the class to still try to see something in the dark. Then the light is turned on. Were they able to see you? Were they able to see what you were talking about?

(2) In a dimly lighted room, have an open magazine propped on a table against a wall. Have a member move slowly away from the magazine until she can no longer read the small print easily but the large print with no difficulty. Mark this spot where she is standing and then light the room. Ask her to return to the marked spot and again try to read the small print.

(3) Have two girls work under the same level of light, one is knitting a sweater with coarse yarn, and the other one is doing fine-detailed hand sewing. After a while (possibly 10 minutes) ask them how they feel. Does the second feel more eyestrain than the first?

(4) Select two participants who are obviously from different age groups; such as a girl under twenty and a woman near fifty years of age. Ask both of them to thread the same sized needle to see which one does it more quickly. Increase greatly the level of light and have the older

woman thread the needle again. See how the higher illumination helped the older woman to perform the task.

Equipment Required.

(1) Magazine and a piece of chalk.

(2) Knitting and fine-hand sewing.

(3) Needles and thread.

Discussion Guides.

(1) No light means no sight. Light improves our seeing ability. What we learn largely depends upon the light because we receive 87% of our learning process through our eyes. During the night, if there is no light, we can do nothing, so the light gives us greater livability. Besides, light increases beauty and provides more safety in the home, the yard, kitchen, storage, etc., and less eye strain also.

(2) These demonstrations should help us to understand that better lighting is needed when the seeing task is fine and detailed than when it is large. Sewing, reading fine print, and other work such as lace making requires lots of light.

(3) Age changes our eyes as well as hair and teeth. So our seeing ability gradually is reduced. According to research, visual acuity is reduced by 50% between the ages of 20 and 80. Although age changes our eyes, the demonstration shows us we can help older people to keep their sight young by giving them the assistance of the light they need for seeing.

(4) From these demonstrations, we have studied the importance of light; we have shown that better seeing needs better light and we need different levels of light for various seeing tasks.

In relation to your own home lighting, have you asked yourself these questions?

(a) Is my home lighting as good as that next door at Mrs. Chen's?

(b) What activities are carried on in each room?

(c) Do I need better light for some of these activities?

(d) How much light do I need for various activities?

(e) How can I improve my light at home?

After you have attended this class, you may think more about some of these questions and wonder what you can do about your home lighting. Here is a check list which will help you to find out where your home activities are carried on, what kind of activities are carried on in each area, and how to improve the light. Next meeting, will you bring your check list and let us discuss it together. We shall study the ways to improve our home lighting.

Supporting material.

(1) Leaflet on The Importance of Light.

(2) A chart of the learning process percentages received through the five senses.

(3) A check list of home activities. (Table II)

TABLE II

CHECK LIST OF ACTIVITIES PERFORMED IN DIFFERENT AREAS

AND THE LIGHTING CONDITION

Rooms	Conditions	Activities	Reading	Writing	Grooming	Visiting Watch TV	Sewing	Play	Dish Washing	Food Preparation
Living Room	Using Condition	Often								
		Seldom								
		Never								
	Lighting Condition	Poor								
		Fair								
		Good								
Kitchen	Using Condition	Often								
		Seldom								
		Never								
	Lighting Condition	Poor								
		Fair								
		Good								
Bedroom	Using Condition	Often								
		Seldom								
		Never								
	Lighting Condition	Poor								
		Fair								
		Good								
Etc.										

Name_____ ADDRESS_____

Lesson Guide Two - Let Us Measure Light

Purposes.

(1) To learn how to measure the light with a lightmeter.

(2) To learn the factors influencing the reflection of light.

Demonstrations.

(1) Use chalk to draw the parts of the lightmeter on the blackboard and study the lightmeter, using the real object.

(2) Show the members how to use a lightmeter to measure the amount of light that an object receives. Place the candle on the table. Measure a distance of one meter away from the candle and have one member of the class hold the paper there so that it is facing the candle. Light the candle and have some one turn off the light. Now, the amount of light shining from the candle on the paper is one Lux.

(3) Calculate a Lux from footcandle readings.

(4) Ask the class members to participate in measuring the light received and reflected from different objects. When you take lightmeter readings for an object receiving light, have the lightmeter glass plate on the same plane as the seeing task, facing the light source. For example, if you are measuring the light falling on a book, the meter should be placed with the cell to the light on the same plane as the book facing toward the light. If the book is being held at an angle, the light should strike the cell at the same angle and from the same direction as it strikes the book. When you measure the reflectance from an object, the sensitive cell should face the object as you look at it.

(5) Divide the class into five or six groups and ask each group to measure the light outside, in the shade of a tree, inside the room near

the window, and away from the window in a dark corner. Then take down the reflectance reading of a dark colored dress and a light colored dress using the same color but different textures and fabrics. Place the readings on the blackboard and discuss them with the class. From the readings, we know the dark color will absorb more light than it reflects.

When applying this to home lighting, this means a dark room needs a higher level of illumination than a lighter colored one. Dark colored walls and ceilings absorb light and thereby require more wattage to provide satisfactory illumination. Light colors which reflect light can increase your illumination from the same amount of current consumption. Though white color produces the highest light utilization, it is not recommended for the ceiling, walls and floor. For comfort and asthetic appeal white or pale-tinted ceilings should range in reflection from 60-85 percent; walls should have a reflection of 35-60 percent; and the floor should have a reflection of 10-30 percent. This is the reason for having the floor in the darkest color while the ceiling is the lightest in color.

Equipment Required.

(1) Five or six yardsticks or metersticks or tape measures.

(2) Several sheets of white and colored papers.

(3) A box of matches.

(4) Five or six standard candles (about 2 cm)

(5) Five or six lightmeters.

Discussion Guides.

(1) Review the last lesson asking the class members about their findings relating to their home seeing activities. Tell them that these

findings will be used in later lessons to improve their lighting situations.

(2) A lightmeter has three main parts. They are (a) the case; (b) the light sensitive cell; and (c) the scale, which is marked in Lux or footcandles. When light falls on the light sensitive cell at the top of the meter, the needle moves along the scale and measures the amount of light the surface receives or reflects.

(3) We measure the light with a lightmeter just like we use scales for weight, metersticks for length, and thermometers for heat. Footcandle and Lux are the two units used in measuring light. In some countries such as in the United States footcandles are used to measure light. In Taiwan the unit is Lux. A footcandle is the amount of light, produced by a standard candle, three-fourth inches (2 cm) in diameter, that falls on a surface one foot away while one Lux is one meter away.[1] The Lux is roughly one-tenth of a footcandle. In other words, one footcandle is equal to ten Lux.

(4) There are many different types and sizes of lightmeters used for measuring light. The most commonly used is the one that photographers use. One can usually be borrowed from the school, power company, or a photographer.

(5) By knowing what kinds of activities are carried out, the light level needed, and the reflection quality factor, we can plan our home lighting. With the two lists from your home check the lighting level for specific tasks and plan the color for your home to improve the lighting conditions.

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[1]Caldwell, Modern Lighting, p. 4.

Supporting Materials.

(1) Recommended Lighting Levels for the Home (Table III)

(2) Light Reflection of Colors (Table IV)

TABLE III

RECOMMENDED LIGHTING LEVEL FOR THE HOME

Use for Lighting	Footcandles needed	Size of Bulb (Watts)
Studying		
Desk lamp	70	200
Wall lamp (above desk)	70	125 (each)
Floor lamp	70	50-200-250
Reading		
Bed table lamp	40	150
Sewing		
Floor lamp	70-100	100-200-300
Difficult and prolonged	200	Use R-30, 75 watts reflector spot lamp, mounted on floor lamp.

The above levels of illumination are recommended by the IES (Lighting Handbook, 3rd Edition, 1959) on specific visual tasks. In addition, general room lighting is essential to have comfortable seeing conditions. The IES recommends the following levels of general lighting: entrances, hallways, stairways and stair-landings, 10 ft-c; living room, dining room, bedroom, family room, sun-room, library, game or recreation room, 10 ft-c; kitchen, laundry, bathroom, 30 ft-c.

TABLE IV

LIGHT REFLECTION OF COLORS

Amount of light reflected by various flat opaque colors		
White.....80-85%	Willow Green...61%	Cardinal Red...20%
Lemon Peel....72%	Cameo Pink.....54%	Cocoa.....15%
Baby Blue.....71%	Dove Gray.....51%	Charcoal.....10%
Tawny Beige...64%	Turquoise.....44%	Hunter Green..8.5%

The above amounts of light reflected by various flat opaque colors is found in Bright Ideas For Brighter Living (Salem, Massachusetts: 60 Boston Street, Sylvania) p. 14.

Lesson Guide Three - The Factors Affecting Our Seeing Tasks

Purposes.

(1) To learn that good quality as well as sufficient quantity of light is needed for better seeing.

(2) To learn the factors that influence quality of light.

(3) To learn how to improve the lighting quality in homes.

Demonstrations.

(1) Light a clear bulb behind a hole in a piece of card-board so that light shines through the hole and ask the class to read the message around the hole. Do it again with the frosted bulb replacing the clear bulb and find out in which experience it is easier for them to read the characters. Does one way feel more comfortable to the eyes?

(2) Light the clear bulb; let the class watch it for one second, and then hold a piece of transluscent plastic plate or tissue paper between the lighted bulb and the class members. Let the class decide which one, the light from the bare bulb or the light through the plastic plate makes seeing more comfortable.

(3) Have two members from the class, one in a dark colored dress, and one in a light colored dress try a silver and a dark brooch on their dresses and ask the class what makes the difference in the appearance of the brooches on the dresses.

Equipment Required.

(1) One silver and one dark colored brooch.

(2) A clear and a frosted bulb.

(3) A piece of cardboard, thirty centimeters square with a ten

centimeter diameter hole in the middle of it and characters written along the edge of the hole.

(4) A piece of transluscent plastic or a piece of tissue paper thirty centimeters square.

Discussion Guides.

(1) In the last lesson we discussed the amount of light needed for various activities. Although a sufficient amount of light is needed for performing a better job, not all high level light is good in quality. This means that there are other factors that affect the light in better seeing.

(2) We can not see easily and comfortably when we have glare. Glare is the raw, irritating light that makes us uncomfortable and often makes an object hard to see. It can be very annoying and may be the source of fatigue, headache, and dizziness. Glare comes in several ways. The unshielded bare light bulb is one way. This is called direct glare. The reflection of light from a shiny paper, a mirror, or a highly polished table top is another way and is called reflected glare. Light should shine on what you are trying to see but not in the observer's line of vision.

(3) Bright spots of light, either direct or reflected glare, are uncomfortable to our eyes. It has black and sharp shadows. Adequate diffusion to spread the light, like in the demonstration where we used the transluscent plate to break up the light from a bright spot into a larger area, is the answer to avoid glare and soften the shadows to ease eye fatigue. This is why we use a lamp shade to shield a bare bulb. It prevents the glare from getting into our eyes. Other ways to avoid

reflection glare are to remove the offending light source from the line of vision or reposition the lighting source. The way to test whether the light is well diffused or not is to place a pencil about ten centimeters away from the seeing task; if the shadow in that area is not black and sharp but very blurred, it is a well diffused light.

(4) The higher the contrast of color or brightness of two objects, the easier it is to see the object. Because of contrast, a silver brooch is easier to see when it is on a dark dress and a dark colored brooch is easier to see on a light colored dress. For the same reason writing from a soft lead pencil is easier to see than from a hard one on light colored paper. So, in order to see better and easier, have higher contrast within your seeing task. This contrast is only within the seeing tasks and should not be confused with the contrast between the seeing task and the immediate environmental background. Sharp contrast in environmental background and seeing tasks cause eyestrain because the pupil of the eye has to open and close so often in looking from the sharp light of the seeing task into a dark environment.

(5) From these demonstrations, we know that the factors - brightness, diffusion, and contrast - affect our seeing ability a great deal. The seeing task includes three parts: the eye, the task, and the light. We cannot change the eye and the task but we can improve our light quality to help us do a better job in seeing.

(6) Good quality of light is free from glare, has high contrast within the task and low contrast between seeing task and surroundings, and is well diffused.

(7) Everybody wants to do a better job and to be more comfortable while doing it. Use the check list in your home to find out about your

light quality and suggest ways to improve it.

Supporting Materials.

(1) Leaflet: Facts of Good Light For Our Seeing.

(2) Check list: Lighting Quality in Your Home (Table V).

TABLE V

CHECK LIST FOR QUALITY OF LIGHTING IN YOUR HOME

Light Location	Factors	Condition	How can you improve it?
Living Room	Diffusion		
	Glare		
	Contrast		
Bedroom	Diffusion		
	Glare		
	Contrast		
Etc.	Diffusion		
	Glare		
	Contrast		

NAME_____ ADDRESS_____

Lesson Guide Four - Lighting Sources

Purposes.

(1) To identify the types of modern lighting sources.

(2) To learn how the fluorescent and incandescent bulbs affect us.

Demonstrations.

(1) Have either a local service company or an electrical supply dealer show the different types of incandescent bulbs and fluorescent tubes; or

(2) Visit local electric supply stores or the bulb and tube factories.

(3) Use swatches of fabric in the color reflectance box to show the influence of incandescent and fluorescent light on colors and texture.

Equipment Required.

(1) A variety of incandescent light bulbs:

(a) Different watts, shapes, sizes: 7, 25, 40, 100 watts; bulb pear, "F", and "S" shapes.

(b) Reflector bulbs.

(2) A variety of fluorescent tubes:

(a) Different watts and lengths.

(b) Different colored "whites".

(3) A home made color reflectance instrument which is a compact box designed for using fluorescent tubes or incandescent bulbs to show the affects produced by them on the fabrics of different color, texture, and design.

(4) One meter each of pink, green, blue, white and figured fabrics

of a variety of textures similar to ones used in home furnishings.

Discussion Guides.

(1) There are two kinds of electric lamps used for lighting at home: incandescent bulbs and fluorescent tubes. The incandescent lamp is the light given by the passage of an electric current through a tungsten filament inside of a vacuum glass bulb. Its operation is based on the fact that when an electric current is passed along the tungsten filament, the resistance to its passage produces heat. If sufficient electrical energy is supplied to raise the temperature above 500 degrees Centigrade, light is emitted as well as heat.

(2) The fluorescent lamp is a "phosphors" coated clear glass tube with an electrode sealed in each end. A drop of mercury and a small amount of argon gas are also sealed into the tube. When the electric current is turned on, the heat changes the mercury into vapor and the argon gas provides a path for the flow of electric current through the tube. In so doing, invisible ultra-violet radiation energy is released. When the phosphors receive the invisible energy, it gives off a visible fluorescent light.

(3) Each of these two lighting sources has advantages and disadvantages.

(a) Fluorescent light tubes:

1. Provide a "line of light" and give better diffused light so it is low in brightness contrast and causes less glare.
2. Provide a "line of light" which can be used above the mirror, under the cupboards and as decorative light.

3. Provide about seven to ten times longer life than that of the incandescent light bulbs.
4. Give wider choice of types of color but need accurate careful selection.
5. Are more expensive to buy, to install and service because ballast and starter are needed but more economical to operate because they give three to four times more light per watt than the incandescent bulbs give per watt.
6. Provide cool operation, radiate relatively small amounts of heat to the amount of light they emit. Therefore fluorescent lighting is good for summer.
7. Are relatively slow to light and frequent starts shorten the hours of operation.
8. Create stroboscopic effect which can be minimized if several lamps are operated in pairs or side by side.

(b) Incandescent light bulbs:

1. Provide a "point" source of light that can be focused or directed over a limited area as desired.
2. Can be easily increased or decreased within certain limits by changing the bulbs to a different wattage.
3. Are less expensive to buy and service but more expensive to operate.
4. Permit more frequent turning off and on without damaging the bulb parts.
5. Produce much more heat than fluorescent tubes so they are not economical when an air conditioning system is

installed.

6. Produce more light per wattage of electricity as the light bulb wattage increases, e.g. one 100 watt bulb gives at least 50 percent more light than four 25 wattage bulbs.

(4) There are a variety of "white" color fluorescent tubes on our markets today.

(a) Natural white: This color is the best source to use wherever color rendition is of prime importance. Its delicate warm pink cast gives brighter, clearer, more natural rendition of almost all colors. It makes personal appearance, clothing, surroundings and merchandise appear to best advantage. It creates a psychologically "warm" atmosphere.

(b) Deluxe warm white: This tube has an orange white light with a warm beige cast flattering to people and surroundings. It is generally recommended for general home use, for social and commercial environments. It accents reds and yellows, deepens blues and greens, and gives a yellow cast to blue-greens.

(d) Daylight: This tube has a very blue white light similar to the natural daylight. It makes cool colors bright and clear, and tones down warm colors. It is frequently used for color matching or discrimination, because it accentuates color differences. It is often used in industrial and work areas, but has an unflattering effect on complexion and personal appearance because it grays complexions

and the reds and pinks in room coloring.

(5) Incandescent bulbs vary in shape, in number of watts and in treatment of the glass bulb. Some are pear shaped, some are tubular, others are bulb shape, etc. Incandescent bulbs also vary as to the treatment given the glass while it is being manufactured into a light bulb.

(a) Clear glass bulb: This bulb gives a bright glare and is only used where high visibility is important but color discrimination is not. It is not a satisfactory bulb for home use. If this type of bulb is used it needs a good lamp shade to provide diffusion of the light.

(b) Inside frosted bulb: The frost is the result from acid etching the bulb's interior. Because the slightly roughened finish breaks up the light rays into short lengths of light, the light is less bright than the clear bulb. Thus the glare is reduced. Its orange cast creates a "warm" atmosphere and enriches warm colors, but tends to dull and deaden cool colors, such as green and blue.

(c) Silican coated bulb: This is the bulb that has its inside coated with white silica particles. The light of this bulb is distributed over the entire bulb surface, eliminating the bright spot near the filament and spreading the light into a bigger area. Thus there is less glare and less shadow too.

(6) From the demonstration with the color reflectance box, it is very easy to see that fabric colors are affected by the fluorescent tubes. Both incandescent bulbs and deluxe warm white fluorescent bulbs

have the characteristic of natural light. They are more flattering to foods and people's complexions. Cooler colored bulbs are unflattering to complexions and furnishings. After we have learned the advantages and disadvantages of fluorescent tubes and incandescent bulbs and their color effects, we can judge what kinds of bulbs or tubes we want to use in our home. The specific choice depends on the purpose, the location and the cost.

Supporting Materials.

(1) Leaflet: Fluorescent and Incandescent Light.

(2) Leaflet: "Do's and Don'ts" of Fluorescent Light in the Home.

Lesson Guide Five - General Lighting for Different Rooms

Purposes.

(1) To learn what is general lighting.

(2) To learn how to provide the amount of general light needed in different rooms.

Demonstrations.

(1) Use a projector and discuss the slides showing structural lighting.

(2) Make a wall bracket light suitable for a bookshelf and light over a desk.

(3) Use the light meter to measure quantity of general lighting in the classroom.

Equipment Required.

(1) Slides to show structural lighting: cornice, valance, wall bracket and a variety of ceiling fixtures.

(2) Wooden boards: 2 pieces, 30x12x2 cm; 1 piece, 100x25x2 cm; 1 piece, 100x12x2 cm.

(3) Plastic or glass plate: 1 piece, 100x30 cm.

(4) "L" shaped brackets: 2 or 3

(5) Tools: hammer, screwdriver, meter stick, nails, screws.

(6) Lightmeters.

Discussion Guides.

(1) General light or "fill-in" light is a low, but not necessarily even, amount of light throughout the entire room area. It is the light to fill in between local light. It is adequate for moving about, for

most housekeeping, and for softening the areas of local light.

(2) General light is provided by ceiling fixtures or structural lighting. There are many designs of ceiling fixtures in today's market. These fixtures may contain one bulb or many. The bulbs may be visible or covered with diffusion bowls, plates or shades. We buy according to our tastes and needs.

(3) The most common structural types of general lighting are the cornice, valance and bracket light.

(a) Cornice: This kind of structural light directs all the light downward to give dramatic interest to wall coverings, draperies, murals, etc. It may also be used over windows where space above the window does not permit valance lighting. It is good for low-ceilinged rooms.

(b) Valance: This lighting is always used at windows, and usually these windows have draperies. It provides up-light which reflects off the ceiling for general room lighting and down-light for drapery accent. When the valance board is closer than ten inches to the ceiling a closed top is used to eliminate annoying ceiling brightness.

(c) Wall bracket (High type): The high wall bracket provides both up and down light for general room lighting. It is used on interior walls to balance window valance both architecturally and in lighting distribution. The mounting height is determined by the window or door height.

The low brackets are used for special wall emphasis or for lighting specific tasks such as sink, range, reading in bed, etc. The mounting

height is determined by eye height of users, from standing, sitting, and lying positions. The length of the bracket should relate to nearby furniture groupings and room scale. With the right tools, some knowledge and manipulative skill, it is not too difficult to build a wall bracket light suitable for a study center.

(4) Rooms in our homes are used in different ways. Lighting specialists have made some suggestions for providing enough general light for different rooms. These suggestions may be adapted to improve the lighting in one or more of your rooms at home.

(a) Living-room: In a small living room, a ceiling fixture of no more than forty centimeters in diameter and no less than 200 watts of incandescent light is adequate. A minimum of two and one-half meters of fluorescent tubes in cornice, valance, or wall bracket, or the equivalent in incandescent wall brackets or ceiling downlight would also be sufficient general light. In a bigger room, on at least two entire walls, 30 or 40 watt rapid-start fluorescent tubes at the end of the cornice, valance, or bracket are needed. Of course, in addition to these general lighting sources, some other fixtures or lamps may be used for local lighting.

(b) Dining area: One ceiling fixture, suspended over the dining table providing predominantly down light and incorporating a minimum 150 watts is adequate. Some possible additional light may be used for decorative effect.

(c) Kitchen: A ceiling fixture, a light over the sink, and possibly over another work area is sufficient. The

ceiling fixture does not have to be centered. It may be off center above where the main tasks are done; for example, a light over the cooking counter with washable shade might be used at this work center instead of the centered fixture. For general lighting the one fixture may be surface mounted, or pendant, depending on the ceiling height. A single 175 or 200 watts incandescent light bulb mounted in a fixture with a minimum diameter of 35 centimeters or a 60-80 watt fluorescent tube is enough for a medium sized kitchen.

(d) Bed room: A big bedroom needs one center fixture. It should be a close-ceiling type utilizing 200 watts in four sockets. The minimum fixture size would be forty centimeters across. In a smaller room, one center fixture of thirty-five centimeters in diameter and 120-180 watts of light would be sufficient. In terms of wall lighting, this means a structural unit two meters long. A portable light is needed when reading or sewing is performed in this area.

(e) Bathroom: A wall bracket on each side of the bathroom mirror is suggested. Two portable wall or table lamps can be used also.

Supporting Materials.

(1) Leaflet: Have Sufficient General Light for Your Home.

(2) Leaflet: You Can Build Your Own Structural Light-Cornice, Bracket, Valance.

(3) Flip chart of structural lighting with detail instructions.

Lesson Guide Six - Local Light for Specific Tasks

Purposes.

(1) To learn what local lighting is.

(2) To learn how to provide good local lighting.

(3) To understand the importance of a well planned, adequately lighted study center.

Demonstrations.

(1) Have someone seated at a desk. Use a small shade, a drum type shade, and a standard shade on the same lamp stand in the same location, marking for each shape shade the area of light cast on the seeing task. Note how much wider is the light cast by the standard shade.

(2) Use the goose neck lamp to show the difference between it and the well designed portable study lamp and the wall bracket light discussed in Lesson Five.

(3) Build a study center.

(4) Use the lightmeter to relate quantity of light at a task to the recommended amount of light.

Equipment Required.

(1) Several large sheets of paper.

(2) A well designed portable study lamp.

(3) Bulbs - 50, 100, 150, 200 watts.

(4) Lamp shades - variety of sizes, shapes, and color.

(5) Sugar cane board (60 cm x 100) with light opaque color paint.

(6) Large pastel colored blotter.

Discussion Guides.

(1) Local light is some times called "task light" or "functional light". It is needed for such visual tasks as reading, sewing, studying at a desk, or preparing food in a kitchen at a range, sink, or other working counters.

(2) Study and sewing areas are especially important for the family with members who like to read, to sew and to work at a desk a great deal. Functional light in kitchens is important because many homemakers spend more than half of the working day in the kitchen preparing food, etc. Good light not only provides cleaner dishes and pans, less burned food, fewer cut fingers, but may make the homemaker feel more pleasure and less frustration in her work.

(3) Portable lamps and fixtures can be used together or separately. Portable lamps give the desired local light that is needed for fine detail activities. Wall or ceiling mounted, pull-down lamps and swing and swing-arm floor lamps can be used for local light too. The size of the shade and the height of the lamps are very important. The bottom of the shade should be big enough so that the light can fall on the area that needs the light.

(4) For reading the height of a table lamp should be the table height plus the distance up the lamp base to the bottom of the shade which is equal to the eye level of the seated person (approximately 100-105 cm off the floor). As for the height of the floor lamp, the distance from the bottom of the shade to the floor is the measurement to take. The bottom of the shade should be at the level of the user's eye too.

(5) For a sewing task, it is recommended that 300 watts of

incandescent light are needed for hand sewing. If there is much fine detail, or if the sewing is to be over a prolonged period, a 75 watt reflector bulb can be clamped to the stem of a floor lamp. This clamped bulb should be positioned below eye level, and about 40-45 cm from the task.

(6) For machine sewing the best way is to use a drop cord lamp or a wall lamp. The lamp should give good diffusion and have a shade of 20 cm diameter. It is placed about 30 cm to the left side of the sewing needle, 20 cm behind the needle and the bottom of the lamp shade should be 35 cm above the sewing machine. One 150 watt frosted bulb is best and will supplement the built-in sewing machine light, if there is one.

(7) For kitchen counter, range, or sink light, one 20 watt for each one meter of counter as the specific light in addition to the general light is enough. Since the tube gives a line of light, it is desirable to use the fluorescent tube rather than the incandescent bulb under the cupboard or above the sink. Never work under your own shadow is one good rule for good lighting in a kitchen.

(8) Care should be taken to avoid the mistake of leaving the rest of the room dark while using a single lamp to light a reading, or sewing, or study area. This arrangement, because of its excessive contrast, promotes eye strain, fatigue, and reduces the seeing efficiency. When used as the only light source, the goose neck, pole, or high intensity lamps are not good for any seeing task because they cause harsh reflectance glare, and they do not give surrounding light which is necessary for eye comfort. So always use these types of lamps as additional light to the general light for sewing, reading and other detailed tasks.

(9) Remember that even the best study lamp can not provide a good

unless it is positioned correctly. Light that is properly placed in relation to the task will not bounce glare from your work into your eyes, and will not cast harsh shadows on your work.

(10) Every family needs a place for writing, especially when there are school age children in the family. The desk should be placed against a light tinted wall, never facing a window because that area is bright during the day time and dark at night. The wall is light-tinted because it reflects more light. A sugar-cane board painted in a dull light color and placed against a dark wall perpendicular to the desk top may be used for improving the light. The flat top desk or table work surface should be about 60 x 100 cm. To prevent glare a pastel blotter may be used to eliminate a sharp contrast or reflection from a highly polished work surface. The desk surface should be about 70-75 cm high from the floor. The lamp is placed on the opposite side of the user's writing hand, about 30 cm from the center of the task and about 45 cm away from the edge of the desk. This prevents one from working in a shadow. The bottom of the shade should be at least 40 cm wide.

Supporting Materials.

(1) Leaflet: Lamp Locations for Reading, Sewing and Grooming at Home.

(2) Leaflet: How to Make Home Work Lighter.

Lesson Guide Seven - Lamp Shades and Bulbs

Purposes.

(1) To learn how to select a lamp shade.

(2) To learn how to take care of the bulb and the shade.

Demonstrations.

(1) Make a lamp shade, or recover a lamp shade frame.

(2) Use lightmeter readings to show the effects of shades and clean bulbs.

Equipment Required.

(1) Cleaning supplies: soap, wax, dust-cloth, etc.

(2) Materials for making lamp shades or covering shade frames: sheets of opaque or translucent plastic, light colored fabric, wire, scissors, and glue.

Discussion Guides.

(1) Today the right lamp shade is very important because a portable lamp is not only chosen for function but for adding charm and beauty to the home. Functional usefullness should be considered first. When you buy a lamp and lamp shade, you should know what you want the lamp for. The second thing you should know is where you want to use it. Based on what we learned in the last lesson, you can decide on the height of the portable lamp. Features of a good lamp include:

(a) Open at the top, the light will be thrown upwards on the walls and ceiling and the bottom of the shade should be wide enough to have enough light spread over the seeing area.

(b) The shade should be deep enough to conceal the bulb from view of a person standing or sitting.

(c) A white or egg shell white color lining is best. It permits the maximum amount of light through the lamp shade. Dark color absorbs light so it is not good for a task light but for decoration.

(d) The shade should be dense enough to conceal the glare from the bulb.

(e) The color of the shade should be related to the wall. If it blends well with the color of other elements in the room it gives harmony and a restful feeling to the room.

(f) The base of a portable lamp should be heavy enough to prevent its tipping over easily.

(g) The base of a portable lamp should be simple in form and in proportion with the shade.

(h) The lamp should have a diffusor to spread the light more evenly to a wider area.

(i) A lamp should have a reasonably good height for various types of seeing tasks.

(2) Dust and dirt on bulbs reduce the useful light as much as 40 percent. For saving money and increasing efficiency, dust the lamp bulbs and tubes regularly using a damp soapy cloth to wipe it; then dry. Never dunk the bulb in water. Plastic or glass reflectors should be washed frequently to remove the dust film. Use a wax to polish the lamp base.

(3) Use the right size bulb. Most incandescent household bulbs are designed to operate for 750 to 1000 hours. The bulb may produce a

larger amount of light for a short time, or much less light for a much longer time. The life of bulbs may be affected by the wattage in your electrical system so you should always replace one bulb with another of the same size. As a bulb burns small particles of the tungsten filament are gradually vaporized upward, often blackening part of the bulb. It is wise to replace darkened bulbs in reading lamps even though they may still give some light. Use the darkened bulbs in halls, closets and basements, where not many seeing tasks are done.

Summary.

In these lessons we have learned that good light means:

(1) Sufficient amount of light for various seeing tasks, such as reading, sewing, housekeeping work, make-up, etc.

(2) Good quality of light; free from glare, contrast and well diffused.

(3) Both general and local light sources in a room.

(4) The light source placed in the correct position; where the light is needed and so one is not working under one's own shadow.

(5) Correct height for a task light lamp; the bottom of the shade is at the eye level of the user's eye.

We have learned how to provide adequate and good light for homes. Now let us start improving the light in our own homes by:

(1) Devising shields for all the bare bulbs and tubes.

(2) Replacing small bulbs with proper sized bulbs in lamps and fixtures.

(3) Installing well-lighted study center for the use of school age children and other family members.

(4) Setting up a well lighted sewing center.

(5) Providing adequate lighting for steps, passageways, and storage areas.

(6) Increasing and improving lighting at main work centers in the kitchen.

(7) Having light for reading at comfortable chairs.

(8) Supplying good light for reading in bed.

Let us make these our goals and the writer of these lessons hopes in the near future we can see improvement in our home lighting with eventual achievement of our goals.

Supporting Materials.

(1) Leaflet: How to Select a Portable Lamp.

(2) Check list: How Right is Your Light? (Table VI)

(3) Check list: How to Improve Your Lamps. (Table VII)

(4) Recommended Minimum Dimensions for Lamp Shades (Table VIII).

TABLE VI

HOW RIGHT IS YOUR LIGHT?

Answer each of the following questions with a "yes" or "no". You will discover how the light situation is in your home.

1. Can you and your guests appreciate the furniture, floor, walls, pictures, and other features in your home after dark?
2. Can you read fine print or thread a needle seated in your comfortable chair or on the sofa?
3. Can your family members do home work or write letters comfortably and easily without becoming nervous, irritable or sleepy?
4. Can you do your work at the area where you want without moving lamps or furniture?
5. Can you see clearly what you eat in the dining room?
6. Can your family members see to wash and clean the kitchen floor or cupboards after dark?
7. Can you wash dishes, clean vegetables, or do laundry without having your own shadow on the task?
8. Can you see the inside of the pots and pans while you are cooking?
9. Can your family members see easily to shave, shower, make-up, or set hair in your bathroom?
10. Can you clean your room, make the bed, change dress and make-up in your bedroom after dark?
11. Can you read in bed in a relaxed, comfortable position?
12. Can you locate articles in your clothes closets without any difficulty?
13. Can you identify night visitors before they step in?

14. Can you walk around the outside of your home at night without difficulty?
15. Is your storage room lighted well enough for working with small household equipment?
16. Can family members work in the storage room without an extension cord?
17. Does your home have enough convenience outlets for portable lamps or electric appliances?
18. Can you walk from one room to another room without difficulty?
19. Are all your light bulbs shielded?
20. Are you using frosted bulbs instead of clear glass bulbs?

TABLE VII

HOW TO IMPROVE YOUR LAMPS

Check this list to improve your portable lamps for best seeing results.

1. Is the bottom of the lamp shade at the level of the user's eye?
2. Is the lamp located so that there are no shadows from hand or body on the task?
3. Is the shade top open thus directing some of the light upward for general light?
4. Is the shade bottom wide enough to spread the light on the task?
5. Is the shade deep enough that people may stand or sit by the lamp without seeing the bulb?
6. Is the lining of the shade white or near white?
7. Is the shade dense enough that there is no "bright spot" showing through the shade?
8. Is the shade color well blended with the surroundings?
9. Is the bulb a frosted one?
10. Does some light pass through the shade as well as above and below?
11. Is the bulb no smaller than 150 watts?
12. Does the lamp have a diffusor that spreads and softens the light?

If you have answered every question and find all of them "yes", you are sure that you have a good portable lamp at home. If not, try to improve it.

TABLE VIII

RECOMMENDED MINIMUM SHADE DIMENSIONS*

Lamp Type	Top Diameter "	Depth "	Bottom Diameter "
Sr. Floor	10	10	18
Swing Type	10	10	16
Jr. Floor-Swing Type	10	9	16
D type	14	6	16
Bridge	8	8	13
End Table	8	10	16
D. Type	14	6	16
Sr. Table	14	13	16
Wall Lamp	8	8	13
D. Type	4	6	14
Study Type-pair	6	7	10
Make-up - pair	7	7	9-10
Double Dresser-pair	8	8	12-14

*Helen J. Van Zante, Household Equipment Principles, Englewood Cliffs, New Jersey, Prentice Hall, Inc., 1964, p. 104.

CHAPTER IV

SUMMARY, CONCLUSION AND RECOMMENDATIONS

In Taiwan there has been a unison cry, "Save our children's eyesight! Stop the crammed sessions!" People blame the crammed sessions in the schools for children's vision getting worse and worse. Recently, a concerned agency made a survey and reported that the cause of the eye defects is due to the low level of illumination, both in the schools and at home.

Poor quality of light is as important a factor as the quantity of light. As stressed in Teaching About Light and Sight:

> You can work in less than optimum lighting conditions,...when lighting is not adequate for a particular seeing task, mental and physical response are slower and less precise. If these poor conditions are continued for any length of time, motivation and morale suffer. The lighting experts have computed for us the quantity of light desirable for some given situations. But there is more adequate illumination than mere quantity of light. Other problems must be solved if we are to meet the requirements dictated by what we have learned about the structure and functioning of the human eye and the possibilities and limitations of different kinds of lighting equipment.[1]

In Taiwan, the area of residential lighting has made slow progress because of limited information. The public knows very little about the

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[1] Teaching About Light and Sight, p. 23.

requirement of quantity of light needed for different seeing tasks, the desired quality of lighting for easy seeing, the proper selection of lighting fixtures, the application of good lighting, and care and use of lighting facilities.

With the realization that home lighting is vital, the purposes of this study were:

(1) To gain up-to-date information on the subject of improved home lighting, so that the investigator may be prepared to assist with the development of this area in the home economics extension program in Taiwan.

(2) To develop a program in home lighting that the Agricultural Extension Planning Committee will want to incorporate into the Home Economics Extension program.

(3) To provide materials in this new subject matter area to the field workers in such a way as to insure the success of the worker in presenting and incorporating the theories and principles in their work with homemakers.

(4) To gain specific knowledge to use in selecting fixtures, and lamps so as to use electricity wisely, safely, and with some degree of comfort, beauty, and adequacy.

It is hoped that after this study is finished and the writer goes back home, she can use the ascertained knowledge to start a better lighting training program for the home economics extension field workers. She has proposed training lesson guides to help them carry out this new subject matter with the rural families more easily and smoothly and to raise their living standards. She hopes the subject matter area will strengthen the home economics extension program, too.

After an intensive study of the lighting area, it has been found that lighting is essential for seeing. As Ehrenkranz and Inman pointed out:

> Poor lighting causes eyestrain and good lighting is an aid in making working conditions safer, decreasing fatigue and nervous tension, improving sitting posture, and making the home a more pleasant and interesting place.[2]

Light, eyesight and the task are three inter-dependent factors in any seeing task. Since nobody can change eyes, or the task, the only way to improve seeing ability and comfort is to provide good and adequate amounts of light.

Better light means having enough quantity of light, free from glare, the correct distribution and properly placed.

There are three kinds of lighting used in homes: general lighting, local lighting, and accent lighting. General lighting is furnished primarily by ceiling fixtures, window valances, cornices, and wall brackets. It is basically background or atmosphere lighting, which blends with light from lamps and other light sources to make rooms look larger, more attractive and harmonious. It makes the entire home bright, cheerful, and safer. General light, with different levels of illumination, should be distributed evenly throughout the living room, dining area, kitchen, bedroom, entrance and hall ways.

A second kind of lighting is local lighting for close seeing such as reading, sewing, studying, writing, and work at the sink or stove. This lighting makes it easier to perform the job. Table, floor, and

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[2]Florence Ehrenkranz and Lydia Inman, Equipment in the Home (New York: Harper & Brothers, 1958), p. 26.

wall lamps are the main local lighting sources. Lamps are a part of the furniture in a room because they provide the beauty and charm besides the light. The correlation of height and position of the lamps are important. The best designed lamp cannot do an adequate lighting job unless it is positioned correctly.

Accent light is the third kind of lighting. It is used mostly as decorative lighting to add spice and beauty to the appearance of the home. This lighting is especially effective for dramatically high lighting items of special interest.

Teaching guides for seven lessons were developed. Each lesson contains purposes, suggested demonstrations, a list of required equipment, points to be included as discussion guides, and supporting materials. The seven lesson topics are:

(1) The Importance of Light.

(2) Let Us Measure Light.

(3) The Factors Affecting Our Seeing Tasks.

(4) Lighting Sources.

(5) General Lighting for Different Rooms.

(6) Local Lighting for Specific Tasks.

(7) Lamp Shades and Bulbs.

The Recommendations

To help this better lighting program to spread faster and broader, the following recommendations are suggested by the writer to the related or interested agencies with the hope they can give a hand to foster and promote this program.

(1) A national organization sponsored by various electric

industries, interested agencies and individuals needs to be organized in order to foster the lighting program. This organization would provide information and research in lighting to the people.

(2) The Power Company and Electric Supply Manufacturers consider establishing a Home Service Section with a specialist appointed who can work with the home economics extension workers in helping the homemakers with lighting and other home electric appliance problems. This development would not only help to promote the sales of products and power but also help raise the standard of living of families.

(3) Better lighting exhibits displayed through the cooperation of the Power Company, lighting supply dealers and extension workers to stimulate people to improve their home lighting.

(4) Encourage lighting specialists and manufacturers to design standard lamps, diffusors, lamp shades, kits of leaflets and display materials. These kits could be used with 4-H Club members and other adult groups to accelerate the better lighting program.

(5) Through the help of the Power Company and lighting supply dealers set up several demonstrations in different areas to show the lighting in homes, "before and after". This should stimulate people's interests in better lighting programs.

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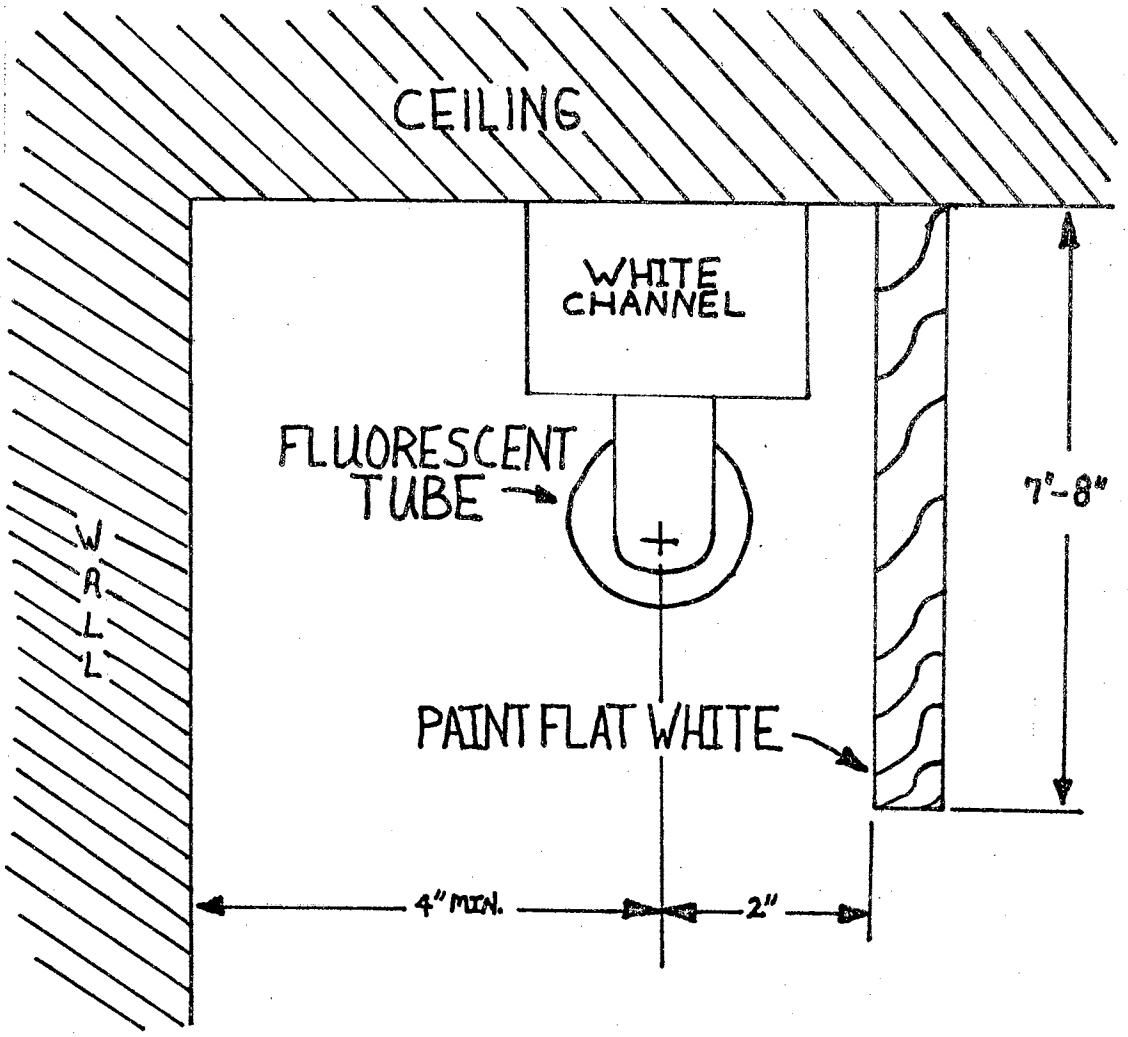
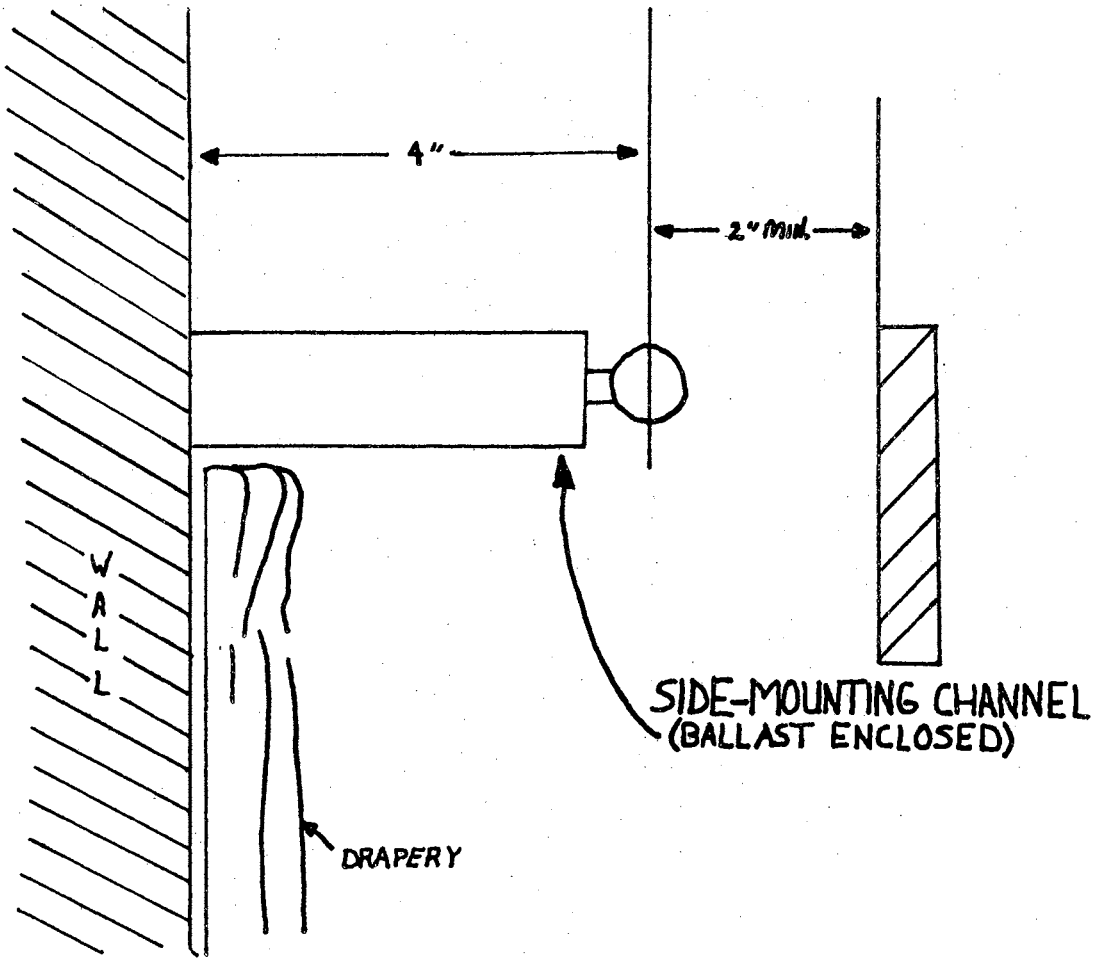
APPENDIX A



Cornice Lighting*

*Lighting...Keyed To Today's Home. New York: Illuminating Engineering Society, 1960, p. 10.

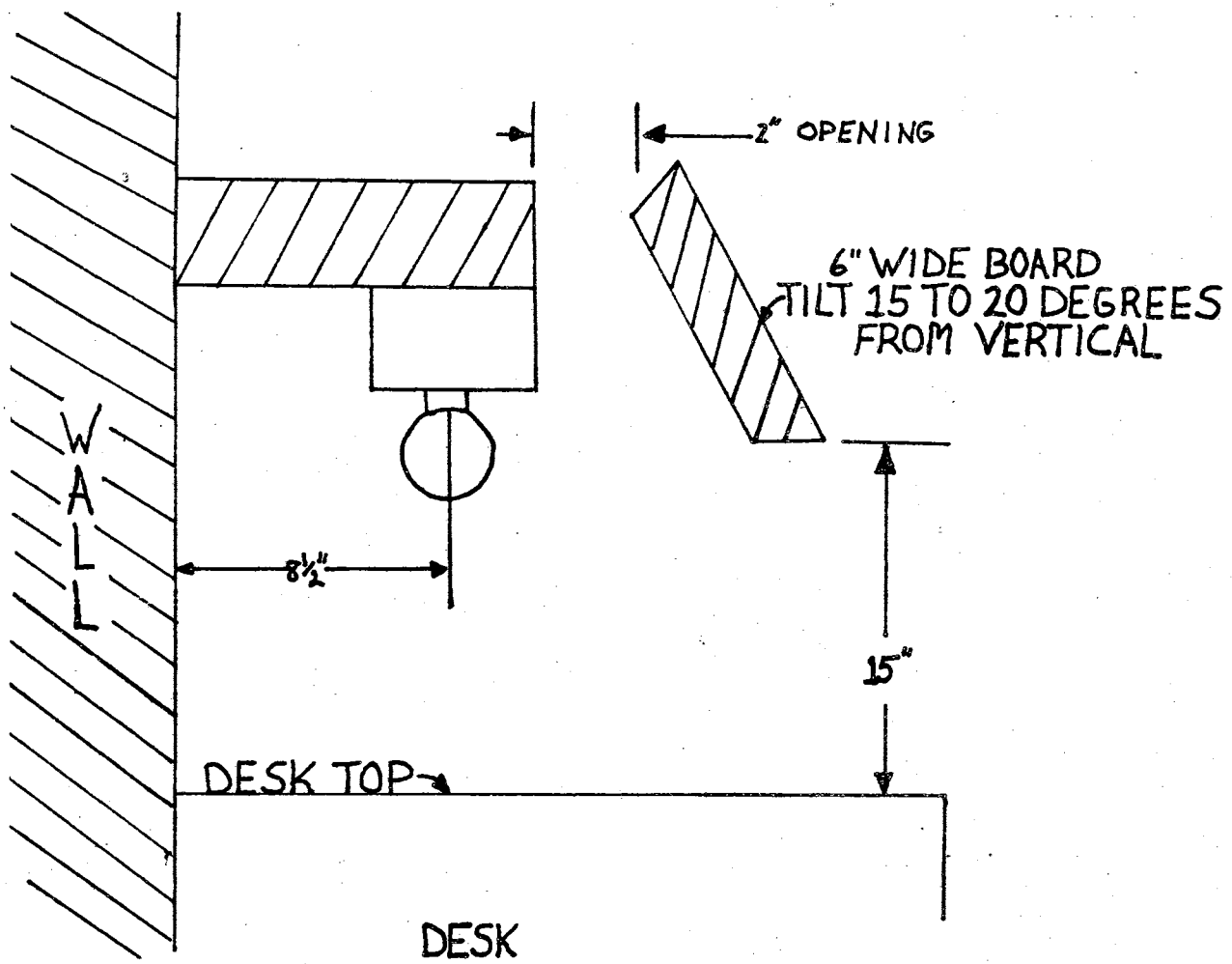
APPENDIX B



Valance Lighting*

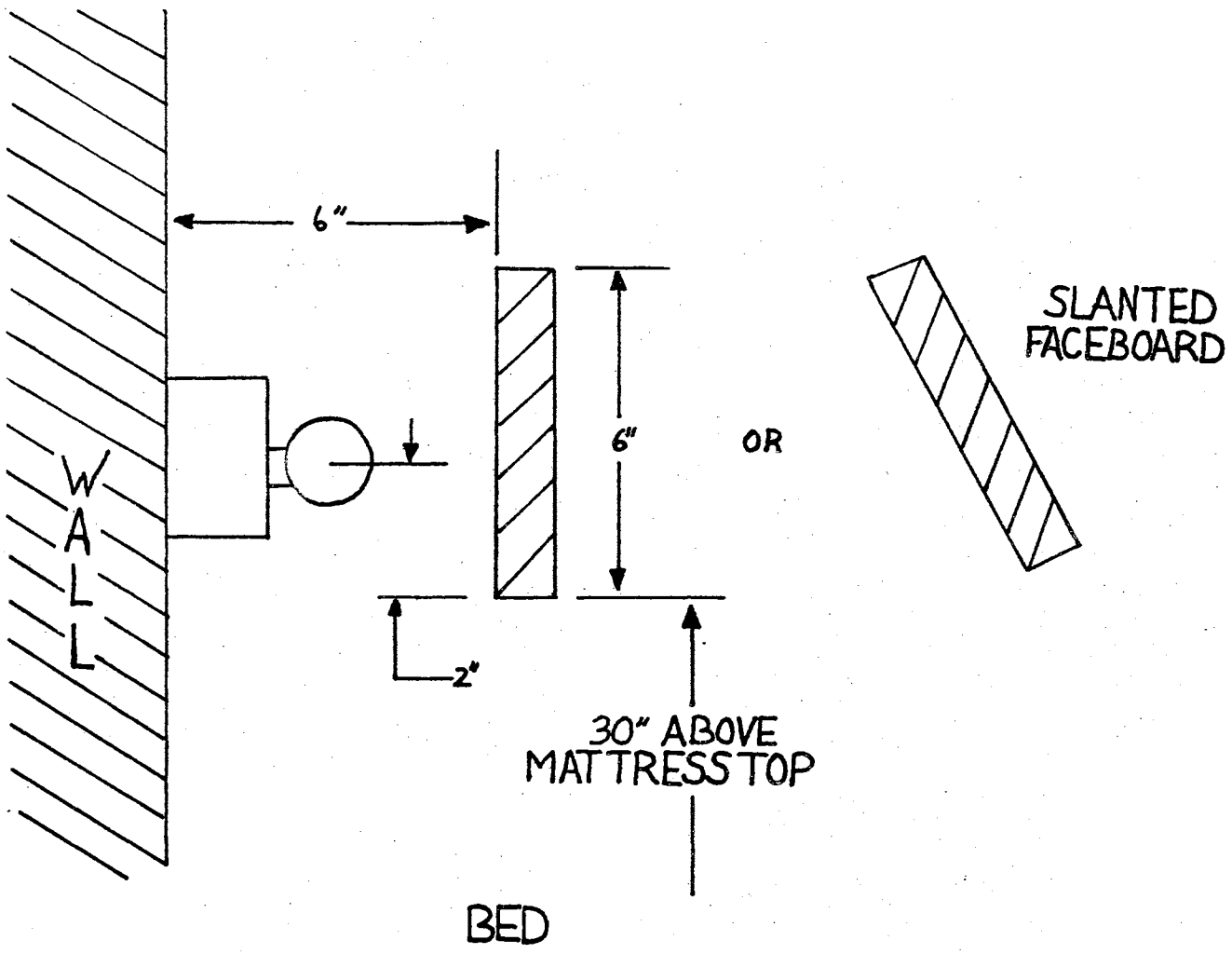
*Lighting...Keyed To Today's Home. New York: Illuminating Engineering Society, 1960, p. 9.

APPENDIX C

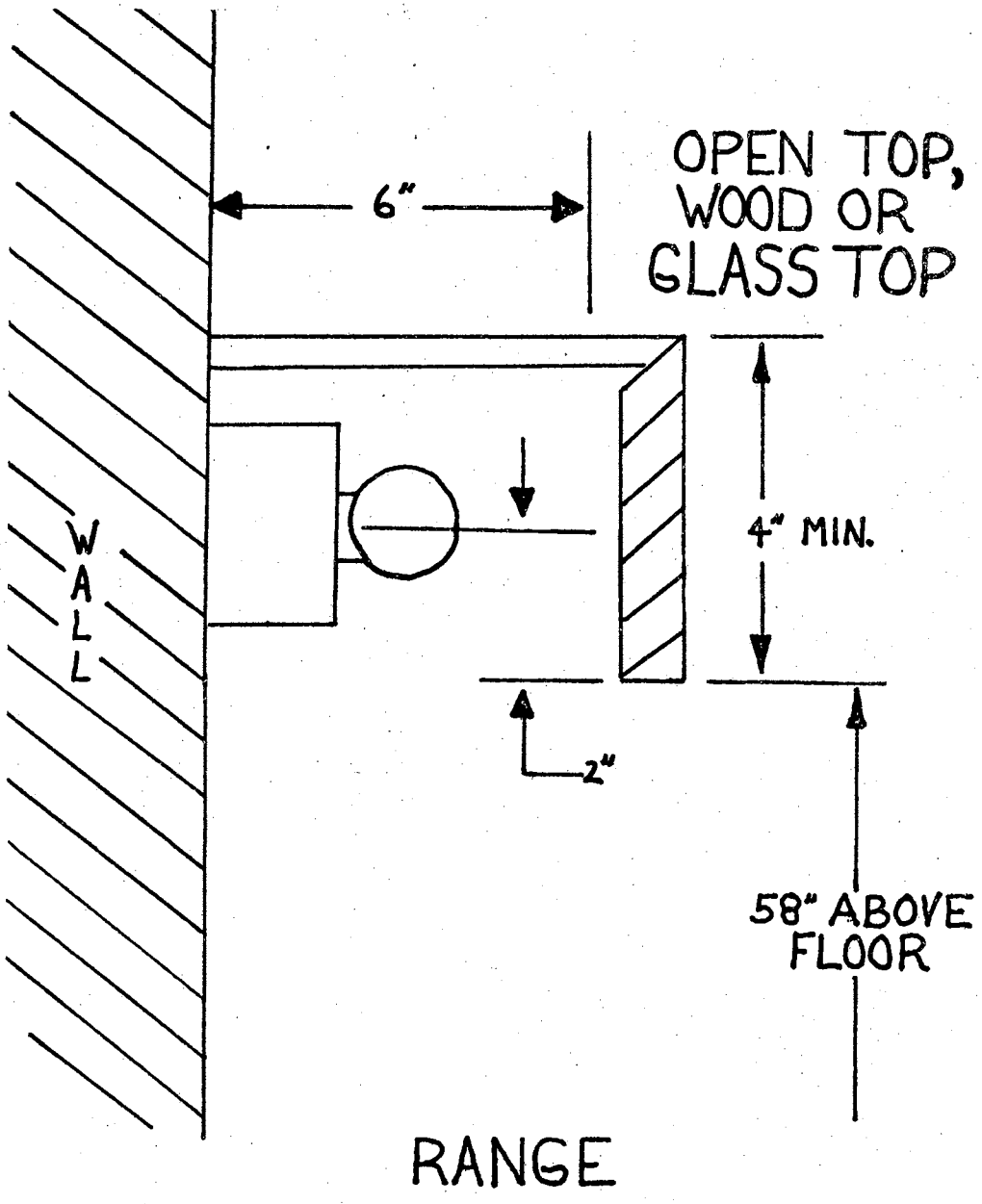


Task Lighting*

*Valence, Cornice and Core Lighting. Mansfield, Ohio: Westinghouse Home Lighting Department. A-6769-4-57, p. 2.



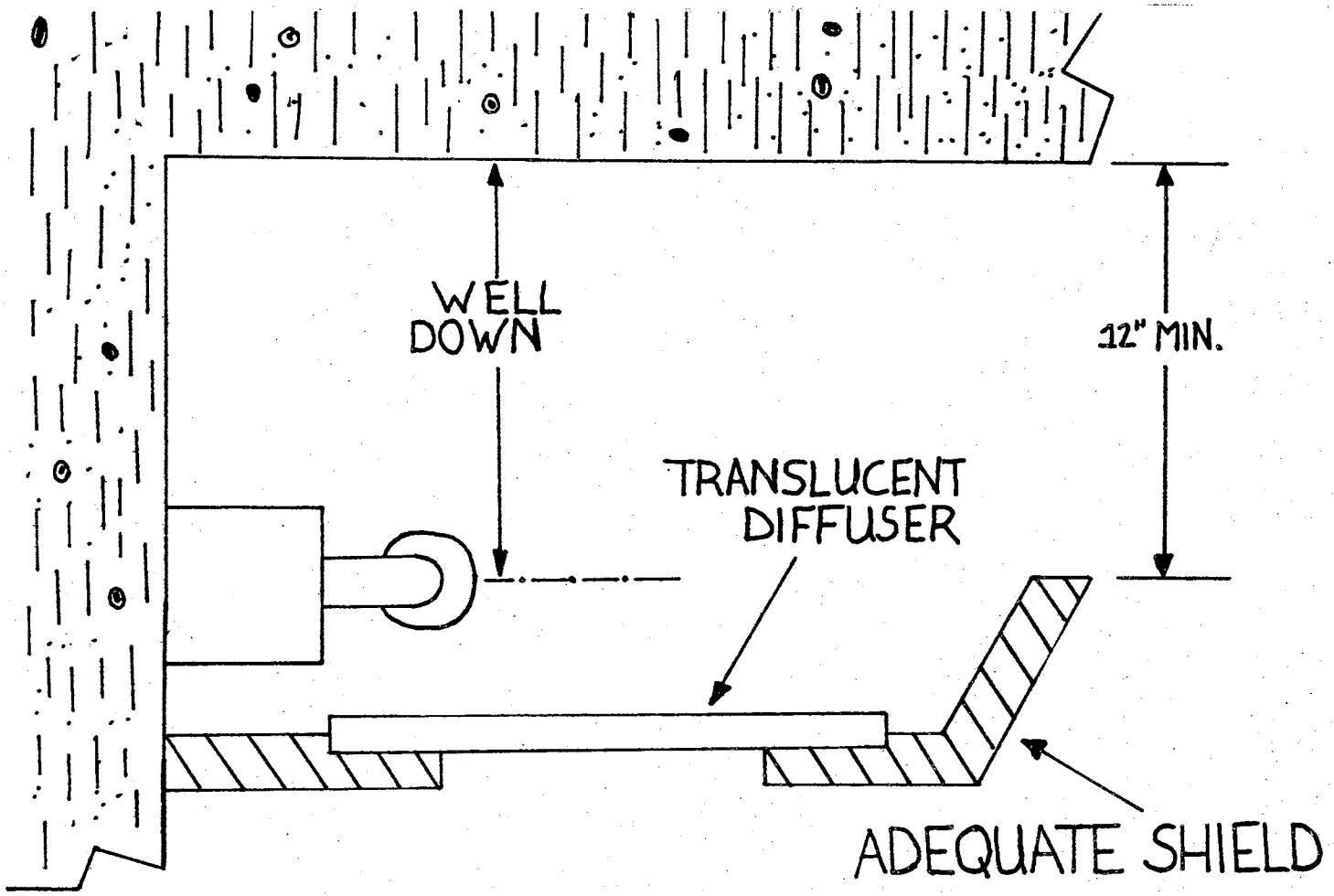
Task Lighting*



RANGE

Task Lighting*

APPENDIX D

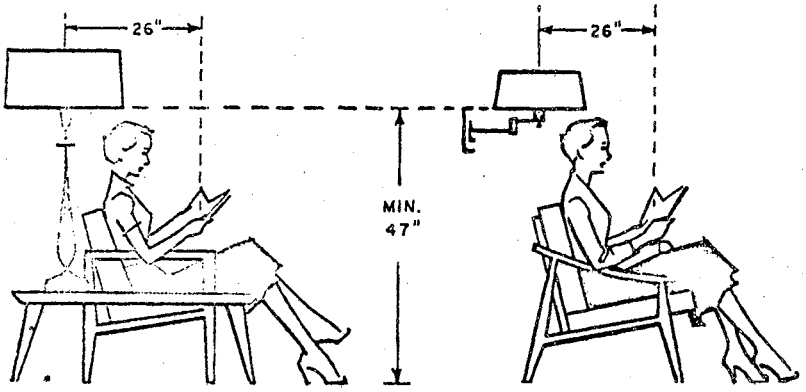


Cove Lighting*

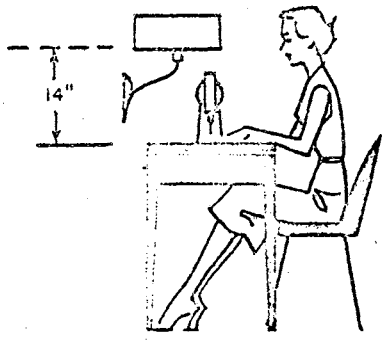
*Built-In Lighting Ideas and Techniques. Dallas, Texas: Power and Light Co., 402-7194, p. 24.

APPENDIX E

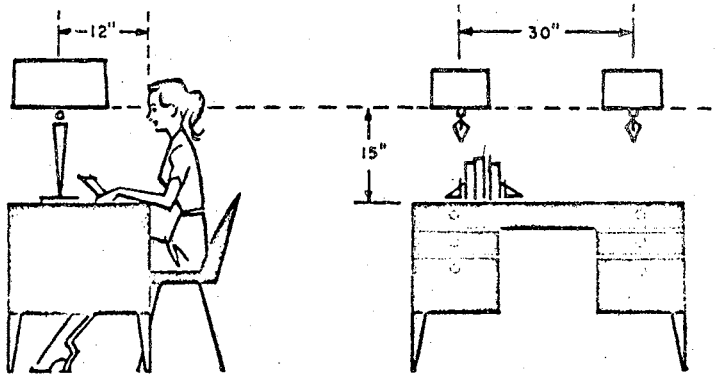
Placement of lamps in accordance with the following directions combines the benefits of the best spread of light with visual comfort for the user.



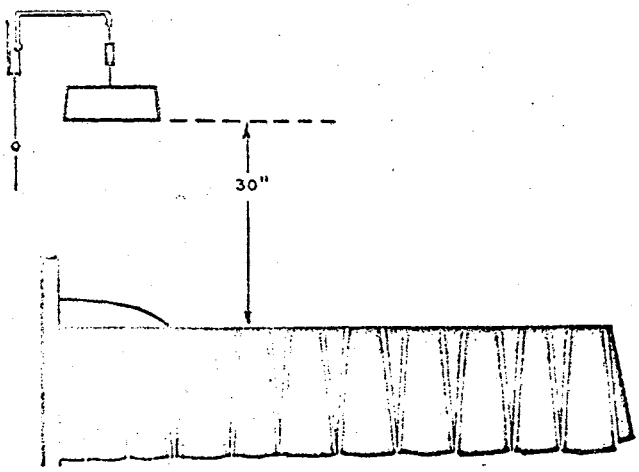
A. Reading: Large table lamp on low table and wall lamp both in floor lamp position—10 inches behind shoulder near rear corner of chair.



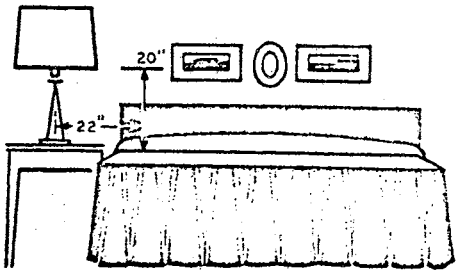
B. Machine Sewing: Wall lamp or swing-arm floor lamp (with vertical adjustment preferred) should be located as illustrated and centered 12 inches to the left of the needle and seven inches behind the needle.



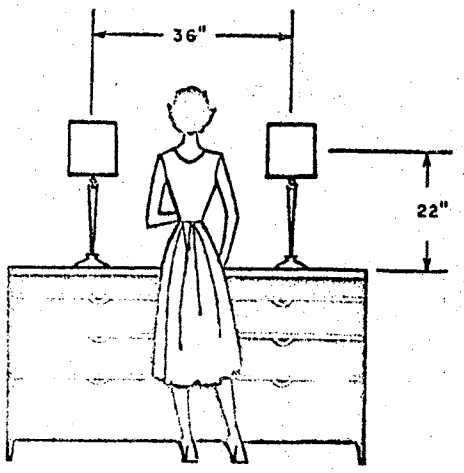
C. Desk Work: Working eye position above task should be about 14 inches. For small children, raise seat height. Shade fairly dense, in a light but not strong color, or opaque. Place desk lamp base center 15 inches to left of work center for right-handed person; to right of work center for left-handed person.



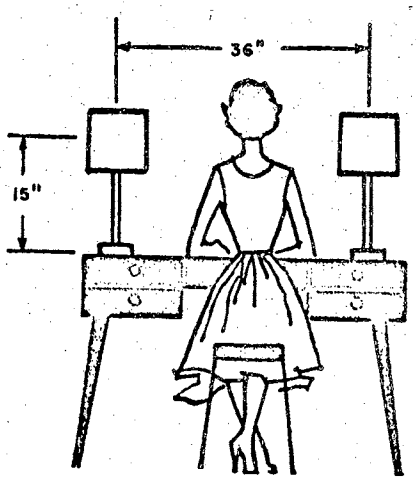
D. Reading in Bed: Wall lamp (left)—type as shown or fluorescent strip behind shielding board, locate bottom of shade or board 30 inches above mattress level. Table lamp (below)—in addition to dimensions shown, position lamp shaft 16 inches back of center of reading plane.

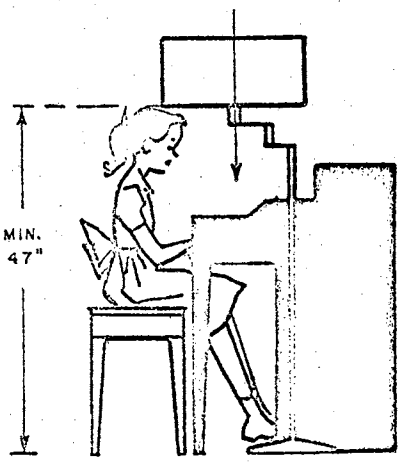


Lamp Placement*

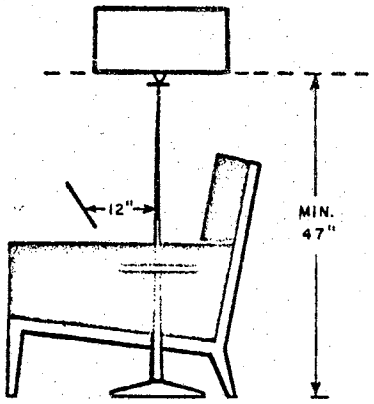


E. Grooming: Dimensions for lamps on a dresser before which one stands and on a dressing table before which one sits. Position lamps as close to mirror or wall as possible. Choose white or ivory translucent shades.

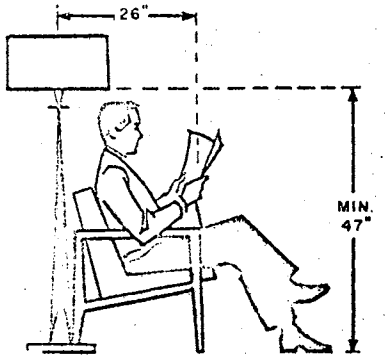




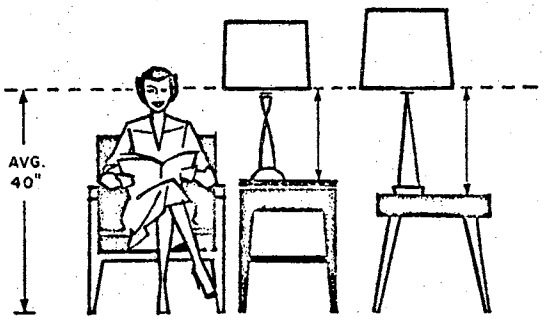
F. Piano: Light center of swing-arm floor lamp 22 inches right or left from center of keyboard and 13 inches forward from music score. Select light-colored shade for generous transmission of light.



G. Hand Sewing: Floor table lamps should be positioned closer to the work—15 inches to the side of the sewing surface and 12 inches back from the surface. Place lamp to the left of a right-handed person and to the right of a left-handed person.



H. Reading: When bottom of shade is above eye level, lamp shaft should be about 10 inches behind shoulder (either shoulder for reading), near rear corner of chair.



I. Reading: When selecting table lamps, follow these directions: lamp base height (measure from table top to shade bottom) plus height of table equals seated eye height (approximately 38 to 42 inches above floor). Place lamp base in line with shoulder and about 20 inches to left or right from center for reading material.

Lamp Placement*

*Lighting...Keyed To Today's Homes. New York: Illuminating Engineering Society, 1960, pp. 45,46,48,49.

VITA

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Candidate for the Degree of

Master of Science

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Major Field: Home Management, Equipment and Family Economics

Biographical:

Personal Data: Born Peiping, China, July 30, 1919, the daughter of S. S. and S. C. Hwang; married F. S. Li on July 30, 1942; gave birth to daughters, Cecilia Li on 23 July, 1943 and Jeanie on 12 September, 1947, and son, Bobby on 23 August, 1944.

Education: Attended grade school in Yangchow; graduated from Howmei Girls' Middle School in 1938, Chungtu; received the Bachelor of Science degree from Ginling College, with a major in Home Economics in 1942, Chungtu, Szechwan, China; completed requirements for the Master of Science degree in May, 1968.

Professional experience: Entered China Nutritional Council, Chungking as an assistant for a year; taught high school home economics 1943-46; joined "Harvest", a farmers' magazine sponsored by the Joint Commission on Rural Reconstruction as an editor, Taipei, Taiwan, 1952-56; transferred to JCRR as the assistant specialist to start the Home Economics Extension program since 1957; at the resignation of the advisor in 1961, was promoted to specialist and appointed as the leader of home economics extension program of Taiwan; concurrently, taught Fundamental Home Economics at Taiwan National University, 1964-66; during 1958-1967 have participated in the following activities:

1. Far East Home Economics Workshop in Vietnam, May 18-30, 1958.
2. Home Economics Extension Observation trip in Philippines, July 1-30, 1959.
3. Second Far East Home Economics Workshop in Philippines, February 8-20, 1960.
4. Home Economics Extension Study in the United States: Universities of Iowa, Nebraska, Florida, Arizona, and Virginia

Polytechnic Institute, August 1-December 20, 1960.

5. Far East Agricultural Extension Workshop in Korea, June 11-23, 1962.
6. Far East Regional Workshop on Role of Women in Rural Development in Philippines, May 30-June 15, 1963.
7. The International Agricultural Leaders' Conference at South Dakota, U.S.A., July 22-August 23, 1965.
8. Extension Evaluation in the State Universities of Wisconsin, Oklahoma, and Hawaii and the Community Development Program in Puerto Rico, sponsored by the United States Department of State, August-September, 1965.