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Measuring Light with Useful Tools

Abstract

Lighting, a necessary part of our home and work environment, is often considered as an afterthought. This article describes tools that Extension educators (Agriculture, Family and Consumer Sciences, and 4-H) can use to measure light levels. 4-H youth may also participate. These tools include light meters and Illuminating Engineering Society (IES) standards. Using the tools as described is new and innovative programming, as it is unlikely that educators or youth have measured light levels before and compared them to industry standards.

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Introduction

Lighting is a necessary part of our home and work environment. In the home, lighting helps us as we do housework, perform personal tasks, and engage in recreational activities. In the workplace, lighting helps us as we perform duties, including physical and mental tasks. In both settings, lighting can help increase productivity, decrease risk of injury, and save energy (DiLaura, Houser, Mistrick, & Steffy, 2011). Extension educators, including Agriculture (Ag), Family and Consumer Sciences (FCS), and 4-H can assist their clients and youth with light levels education and lighting projects.

Why Do We Need to Measure Light Levels?

Light levels affect health, welfare, and safety (DiLaura et al., 2011). Lighting affects work performance. For example, lighting upgrades can boost worker performance (Philips Lighting Electronics, 2008). Lighting can help reduce the risk of injury, and safety is considered important to current healthy homes Extension programming (Maring, Singer, & Shenassa, 2011). In addition, lighting accounts for approximately 12% of home energy use (ENERGY STAR, n.d.) and approximately 35% of commercial energy use (ENERGY STAR, 2006). Inefficient lighting wastes energy. Despite the importance of lighting, it may be considered an afterthought (Ludington,

Johnson, Kowalski, Mage, & Peterson, 2004). In this context, Extension can help clients in ways that may have previously not been considered.

Useful Tools

Light Meter

Extension educators and 4-H youth can help clients define task areas and subsequently use a light meter to measure light levels (Figure 1). Light meters can be used in home/commercial settings to determine task-specific light levels. For example, any task that requires a high level of hand-eye coordination would be appropriate for study. Areas where clients may be at risk for falls, such as stairs, may also be appropriate for study.

"The light meter can help clients understand task-specific light levels."

Recia Garcia
Oklahoma Cooperative Extension Service
Family and Consumer Sciences (FCS) Program Specialist
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Figure 1.
A Light Meter

Light meters are tools that measure light levels and are easy to use with proper instruction. There are many options available at a variety of price points. For handheld models, prices range from about $20 to $400 and higher. Alternatively, there are a number of free or low-cost ($.99 to $2.99) light meter applications for smartphone users. Most models simply require turning the device on, placing it in an appropriate location, and reading a digital output. To ensure data validity, read and follow the product instructions.

Depending on the model purchased, the measurements will be taken in either footcandles or lux. A footcandle is equal to 10.76 lux. Regardless of unit (footcandles or lux), the measurements provide critical information whether the lighting is sufficient relative to the tasks performed in that area.

> "Using the light meter was an interesting experience for me, not having any prior knowledge. I was amazed at the differences in the readings."
>
> Dana Baldwin
> Oklahoma Cooperative Extension Service
> Educator, FCS/4-H/County Extension Director
> Major County

Using a Light Meter

Educators and/or 4-Hers can use light meters to spot check lighting quantities in key areas. For example, participants can take measurements on and around key task surfaces, such as workstations (Figure 2).

Figure 2.
Desk Area

Illuminating Engineering Society (IES) Standards

The measurement can be compared to the Illuminating Engineering Society (IES) recommendations (2009). Your local library may help you locate this resource, via interlibrary loan if necessary. Additionally, some IES recommendations are provided in the ENERGY STAR Building Guide (ENERGY STAR, 2006). Limited recommendations are provided in Table 1.

Table 1.

Selected Light Values for Residential Interiors

	Horizontal Targets (lux) Age of Observer			Vertical Targets (lux) Age of Observer		
	<25	26-65	>65	<25	26-65	>65
Bathroom Shower	25	50	100	10	20	40
Bathroom Grooming	100	200	400	100	200	400
Bedroom Dressing	25	50	100	15	30	60
Closets Walk-in	100	300	600	50	100	200
Dinning Formal	25	50	100	10	20	40

Dinning Informal	50	100	200	20	40	80
Family Room	75	150	300	20	40	80
Foyer Day	50	100	200	15	30	60
Foyer Night	15	30	60	5	10	20
Game Room Cards	100	200	400	75	150	300
Game Room Digital	3	5	12	2	4	8
Source: IES Lighting Handbook, 10th ed., Table 33.2, 2011						

Educators can assist clients in determining if some areas are lower than recommended levels. Conversely, areas with excessive quantities of light may be opportunities for lighting redirection. This strategy can help educators raise client awareness as to the importance of appropriate lighting levels.

Critical Points to Consider: What a Light Meter Can and Cannot Do

When used properly, light meters can measure lighting quantity intended for human use on a task surface. Light meters do not measure other important lighting parameters such as color rendering index (CRI), color temperature, glare, flicker, energy use, etc. Moreover, the lighting quantity measured by light meters does not correspond to what is perceived by human eyes. Factors such as age and condition of eyes may impact or nuance individual perceptions. Educators, 4-Hers, and clients need to be fully aware that light meters measure only one characteristic of lighting.

Putting the Tools to Work

Lighting lends itself to Ag, FCS, and 4-H content. Ag and FCS county educators may be able to engage in lighting programming as a team, reaching clients with their unique areas of expertise.

> "The light meter is a great tool to demonstrate the differences in lighting types and show producers the importance of properly placed lighting in work areas."
>
> Jim Rhodes
> Oklahoma Cooperative Extension Service
> 4-H Youth Development Program Specialist
> Northwest District

4-H educators may consider lighting in programming or projects. Strategizing about lighting and energy may increase enthusiasm for related careers. In today's strained economy, it may be useful to use issues such as this that may affect Ag, FCS, and 4-H content area. This is new and innovative programming, because it is unlikely that educators or youth have measured light levels before and compared them to industry standards.

References

DiLaura, D. L., Houser, K. W., Mistrick, R. G., & Steffy, G. R. (Eds.). (2011). *The lighting handbook* (10th ed.). New York: Illuminating Engineering Society of North America.

ENERGY STAR. (2006). Lighting *ENERGY STAR Building Manual*. Washington, DC: Author.

ENERGY STAR. (n.d.). Where does my money go? Retrieved from: http://www.energystar.gov/index.cfm?c=products.pr_pie

Ludington, D. C., Johnson, E. L., Kowalski, J. A., Mage, A. L., & Peterson, R. A. (2004). *Dairy farm energy management guide*. California. CA: Southern California Edison.

Maring, E. F., Singer, B. J., & Shenassa, E. (2011). Healthy homes: A contemporary initiative for Extension education. *Journal of Extension* [On-line], 49(2) Article 2FEA9. Available at: http://www.joe.org/joe/2011april/a9.php

Philips Lighting Electronics. (2008). Lighting upgrades boost workplace productivity. Retrieved from: http://www.advance.philips.com/documents/uploads/general/SS-2008-AJ-R01_Lighting_Upgrade_Workplace_WP.pdf

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