Vermont House Education Committee Testimony, 4/15/15

My name is Matt Kiley. I live in Peacham, Vermont and have made a living as a lighting designer completing large and small projects in hospitals, factories, offices and schools throughout New England since 1985. For the last twenty-five years my work has been all in Vermont. I am certified to use the initials LC, (Lighting Certified) by successfully passing a four hour exam on the contents of this book, the IESNA handbook. While my projects are funded by the energy they save, my designs are directed by the needs of the users in any given space. In schools, particularly K-12 schools, that means creating a comfortable and effective learning environment. I have audited (161) of Vermont's schools. I've completed new lighting projects in over (100) of them. In the last thirty-one (31) Vermont school lighting installations, I have specified the 2011 lower lighting levels recommendations of the Illuminating Engineers Society of North America (IESNA) 10th Edition Handbook.

I am retiring from the lighting business and therefore have nothing to gain from the formal adaption of the latest IESNA recommendations, but before I do retire, I want to smooth the path for those designers who will follow me in the effort to create the most productive learning environments for our children. That is why I approached Representatives Tolle and McCormack and why I sit before you today.

I have long noted and been told by teachers and staff that light levels over forty (40) foot-candles are annoying to children, particularly the youngest students. Our homes are typically lit to between 5 to 10 foot-candles. With the old IESNA minimum light level of (50) fc, that is 5 to 10 times more light than at home. Students, especially the youngest ones, shrink from the imposition of high light levels and are more easily distracted.

As the use of technology, such as LCD projectors, Smart Boards, I-pads, overhead projectors, personal computers and laptops spread in our schools, light levels over (20) fc become a hindrance to modern and more effective teaching methods because light levels over (20) fc washes out the screen. Consequently, those classrooms with high levels of light have to turn off their lights in order to see the instruction on the board. Now the students are taking notes in the dark. At twenty foot-candles, everyone in the room can see comfortably everything in the room especially what is on the instruction board.

It is most common for me to hear in project follow-up visits, that the teachers find the students calmer, less fidgety and more focused on their lessons with the new lower light levels.

In your packet you'll find the most pertinent page of the 10th Edition IESNA handbook. It is written in "*lux*". There are 10 lux in every foot-candle, so you have to divide these numbers by ten (10) to get foot-candles. You'll note that the highest light level for a classroom where the task is reading or writing is (200) lux or (20) foot-candles. Other functions of the room would recommend less light. There are exceptions for science rooms that need to reach (50) fc for demonstrations, art for color matching, and industrial arts and consumer science for safety reasons. Other-wise in the other 95% of the typical school building, the highest level recommendation is twenty foot-candles.

You will also find the back page of four page Efficiency Vermont brochure promoting the benefits of the new light levels. Please note that the Vermont Agency of Education endorsed these new light level recommendations and allowed the agency logo to be printed on the brochure.

Lastly, please consider these salient comments of Vermont School Superintendents, Business Managers and Principals contained in the letters of support:

Jeff Forward, School consultant to Efficiency Vermont "...teaching staff as well as the facilities staff have been very pleased with the results."

Norm Etkind, Vermont Superintendents Assoc. "I have found that the 20 fc level works well for schools and support this bill that will rely upon the expertise of IESNA when setting appropriate illumination levels."

Chris Kibbe, Supt. Windham Northeast SU "We have had no complaints about the lighting levels"

Chris Locarno, Bus. Mgr. Orange North SU "It has been documented that students are quieter, less fidgety, pay attention better and get less fatigued. I attribute this directly to the lower light levels."

Bob Mason, Bus. Mgr. Chittenden South SU "I have not heard any negatives from occupants (students and/or teachers) to the lowering of lighting levels in classrooms."

Dan French, Supt. Bennington-Rutland SU "Both students and teachers have remarked on how much more pleasant the classrooms are with the lower lighting levels."

Matthew C. Kiley, MA, LC

The ***KILEY*** Company

POB 86, Peacham, Vermont 05862, (802) 592-3965

4/15/15

Table 24.2 | Educational Facilities Illuminance Recommendations cont[illegible]

Notes	Category	Recommended [illegible] Horizontal (E_h) Targe[illegible] Visual Ages of Observers [illegible] where at least ha[illegible] <25	25-65	>65		
(Graphic Arts continued)						
Awards, student art, plaques						
E_h and E_v @artworks						
<50% reflectance		Avg = 5 times E_h of surrou[illegible]				
≥50% reflectance		Avg = 3 times E_h of surrou[illegible]				
E_h and E_v @artworks						
<50% reflectance		Avg = 5 times E_h of surround[illegible]				
≥50% reflectance		Avg = 3 times E_h of surround[illegible]				
E_h and E_v @artworks						
<50% reflectance						
≥50% reflectance						
On drafting board or table						
Also see READING AND WRITING/Xerograph	R	250	500	1000	[illegible]	
See READING AND WRITING/VDT Screen and Keyboard						
See READING AND WRITING, establish tasks and normalize to illumina[illegible] controls to provide illuminance variability if tasks so demand.						
On light table	M	50	100	200	[illegible]	
E_h @2' 6"; E_v @4' AFF	R	250	500	1000	[illegible]	
Architectural lighting illuminances on front of backlit light box	K	25	50	100	[illegible]	
E_h @2' 6"; E_v @4' AFF	R	250	500	1000	Avg	
E_h and E_v @4' AFF	P	150	300	600	Avg	
Interactive experience						
E_h @2' 6"; E_v @4' AFF	K	25	50	100	Avg	
CSA/ISO Type I and II negative polarity screens.[j] E_h @2' 6"; E_v @4' AFF	N	75	150	300	Avg	
Variety of paper tasks.[j] E_h @2' 6"; E_v @4' AFF	Q	200	400	800	Avg	
At all food prep and detailed work areas		500	500	500	Min	C
See AUDITORIA/Lecture Hall						
E_h @3'; E_v @4' 6" AFF	R	250	500	1000	Avg	P
E_h @3' AFF; E_v @4' 6" AFF	T	500	1000	2000	Avg	R
See 22 | LIGHTING FOR COMMON APPLICATIONS/CONFERENCING/Meeting						

Table 24.2 | Educational Facilities Illuminance Recommendations continued next page

IESNA RECOMMENDED LIGHT LEVELS

What is IESNA?

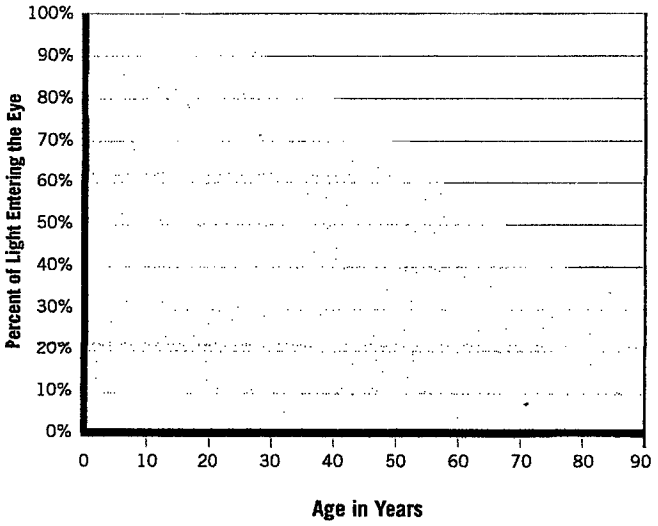
The Illuminating Engineering Society of North America (IESNA) is a nonprofit learned society that was founded in New York City in 1906. The IESNA's stated mission is to improve the lighted environment by bringing together those with lighting knowledge and by translating that knowledge into actions that benefit the public. Members of the IESNA are regarded as professionals in their industry and are globally respected for their knowledge. The IESNA is credited with more than 100 publications on the subject of lighting, most notably *The Lighting Handbook: 10th Edition.*

What are light levels?

The amount of light within a space has a profound impact on humans within that space. Lighting affects our mood, our health, and our ability to perform a task. In order to quantify lighting within a space, we measure the light level using a metric called illuminance. Put simply, illuminance quantifies the amount of light falling within a defined surface area. The unit of illuminance is footcandles (fc) in the United States and lux elsewhere.

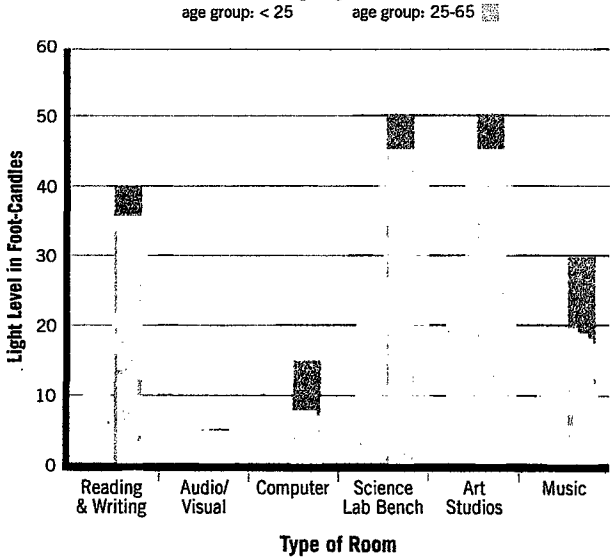
Recommended illuminance levels are prescribed within *The Lighting Handbook: 10th Edition.* The recommendations are based on more than a century of IESNA's experience, research, and knowledge.

Appropriate Light Levels
Depend on Age



Educational Facility
Illuminance Recommendations

Source: IES, *The Lighting Handbook, 10th Edition*



Advancing age reduces maximum pupil diameter and increases absorption by the lens, and combined these effects significantly reduce the amount of light entering the eye. When considering this fact for K-12 schools, where most occupants are less than 25 years old, the IES light level recommendations are notably lower than if the space was primarily occupied by adults.

2014

Jericho Elem

Underhill ID

Shoreham Elem

Flood Brook Elem

Manchester Elem/Middle

Dorset School

Mettawee Union

Currier Memorial

Sunderland Elem

Fayston Elem

Twinfield Union HS

2013

Smilie Memorial

Peacham Elem

CVU High School

Allen Brook Elem

Shelburne Community

Middlebury Union Middle

Bellows Falls Union HS

Williamstown MS and HS

Rochester School

2012

Waitsfield Elem 20/40

St Johnsbury School 20/40

Poulteny High School

Mary Hogan Elem 20/40

Newbury Elem

Washington Elem

Rochester K-12

Vernon Elementary 20/40

Dummerston School 20/40

Putney Central

2015

Orange Center School

NCUJHS

33 Schools

w/ IESNA 10th Edition

Light Levels

Matthew C. Kiley, MA, LC

The ***KILEY*** Company

POB 86, Peacham, Vermont
05862, (802) 592-3965

4/15/15

Forward Thinking Consultants, LLC

2899 Hinesburg Rd
Richmond, VT 05477
802-434-3770
forward@gmavt.net

Tuesday, April 14, 2015

Vermont House Education Committee
Vermont Statehouse
Montpelier, VT

RE: H. 280, An Act relating to rules on school lighting requirements

Dear Chairman Sharpe,

I am an energy efficiency and renewable energy consultant. I have nearly 25 years of professional experience working on energy efficiency and renewable energy issues and projects and have worked with hundreds of schools; hospitals and other institutional facilities throughout the country to help them evaluate their energy opportunities related to biomass, solar and energy efficiency technologies.

Over the past five years I have worked with Efficiency Vermont to facilitate energy efficiency projects in schools throughout Vermont. There are probably few people in Vermont outside of Norm Etkind from the VSA School Energy Management Program who have been to as many schools in Vermont as I have.

One of the common issues I see when I go to a school is overlit classrooms. Maybe this is because lighting design when Vermont schools were originally built was not as sophisticated as it is today. Maybe it is because of the culture in this country of more is always better. But for whatever reason, many if not most classrooms I have been in are over lit and sometimes significantly overlit. Let me provide an example.

I served on the Mount Mansfield School Board for over 10 years. During that time we had Kiley Company perform lighting audits on all three of our schools, Browns River Middle School, Camels Hump Middle School and Mount Mansfield Union High School. When we went ahead with first lighting retrofit in CHMS, were able to reduce the number of fixtures in the building by one third. In the library of that school, Mr. Kiley measured 210 footcandles. The new Illumination Engineers Society of North America (IESNA) calls for 15 footcandles in that application. In addition, there was insulation installed above the light fixtures. The only explanation we could think of for the insulation was that these schools were originally electrically heated when they were built in the early 1970's and that they installed extra light fixtures in the library in order to provide more heat! Remember at that time, electricity was predicted to become too cheap to meter.

Times have changed. The most respected lighting authority in the country, the IESNA, has done exhaustive research into lighting levels for all sorts of applications including classrooms and schools. Their latest standards recognize that teaching techniques have changed greatly over the years and less light is better for most classroom activities. Children actually see better with less light and overlighting a classroom introduces too much "energy" into the learning environment for active kids. In this case less is more.

So I encourage you to pay close attention to Mr. Kiley's testimony. In every instance that I am aware of where Mr. Kiley has specified a school lighting retrofit and reduced light levels, the teaching staff as well as the facilities staff have been very pleased with the results. It turns out that a well thought out lighting design can reduce light levels, increase energy savings and provide a better learning environment all at the same time.

One last point. The purpose of H. 280 as I understand it is to correct an antiquated rule within the Vermont Department of Education Standards that requires a minimum of 50 footcandles for lighting design in public school classrooms. This rule is decades old. The latest IESNA standards encourages lighting designers to design to far fewer footcandles for the very reasons I outlined above. The Department's standards are now rarely enforced because the state provides very little in the way of school construction aid. That could change with the drive to consolidate school districts. I encourage you to change this section of the Department's rules now so that any school construction projects going forward can be in compliance with the IESNA standards and the Vermont Department of Education rules.

Thank you for the opportunity to voice my opinion. I understand that Mr. Kiley is testifying this week in your committee. I would have tried to do in person as well, but am unavoidably out of state this week. If you would like me to testify in person later this session, I will make myself available at your disposal.

Respectfully Submitted,

Jeff Forward, Principal
Forward Thinking Consultants, LLC

Vermont Superintendents Association

School Energy Management Program

Memorandum

To: Vermont House Education Committee

From: Norm Etkind, Director, Vermont Superintendents Association - School Energy Management Program

Date: April 13, 2015

RE: H.280 - - School Lighting Design

Cc: Jeff Francis, Executive Director – Vermont Superintendents Association

Recently, the IESNA (Illumination Engineering Society of North America) has modified the way they describe the recommended light levels for classrooms.

In the Tenth Edition of their "Lighting Handbook", they broke out the age groups for the people using the space. While before they had a blanket 50 foot-candles as the recommended desktop illumination level, for students under the age of 25 the recommended level is now 20 foot-candles.

The Department of Education (now the Agency of Education) at the time used the 50 foot-candle IESNA recommendation to inform their rules for school construction.

Now we know through IESNA that 20 foot-candles is the appropriate amount of illumination for K-12 classrooms.

This new recommended level will save a considerable amount of electricity and provide for an enhanced learning environment.

Since this change I have performed energy assessments on over 100 school buildings in Vermont. Many of these schools had some areas that were already at a 20 foot-candle (fc) level. None of these represented any problem due to lower light levels. Many teachers actually cover up fixtures in the classrooms because they are too bright at the 50 fc level.

In summary, I have found that the 20 fc level works well for schools and support this bill that will rely upon the expertise of IESNA when setting appropriate illumination levels.

Norm Etkind, CEM, MCEA, CBCP Program Director
Phone: (802) 229 – 1017 E-mail: SEMP@vtvsa.org
2 Prospect Street, Montpelier, VT 05602
Fax: (802) 229 - 4739

Efficiency Vermont

April 15, 2015

House Committee on Education
State of Vermont House of Representatives
115 State Street
Montpelier, VT 05633

Re: H. 280 - An act relating to amending the State Board of Education rules on school lighting requirements

To whom it may concern:

The Vermont Agency of Education currently has a regulation related to K-12 classroom light levels stating that:

> In all classrooms or other areas where instruction routinely takes place, the artificial illumination installed as part of a school construction project **shall be capable of providing work surfaces with at least 50 foot candles of light**, without significant glare, except where the intended use of the area requires a higher level of illumination. Illumination guidelines for special applications or other areas shall be as described by Ninth Edition Illuminating Engineering Society of North America Lighting Handbook.

Since this Agency of Education regulation was originally written, much has changed in terms of lighting technology and the lighting industry's knowledge regarding lighting science. Within the *Lighting Handbook, 10th Edition*, published in 2011, the IESNA recommends lower light levels for K-12 classrooms where a majority of the occupants are less than the age of 25. Advancing age reduces our eye's ability to perceive light, and when considering this fact for K-12 schools the IESNA light level recommendations are notably lower than if the space was primarily occupied by adults.

The Lighting Handbook: 10th Edition is recognized as the authoritative reference on the science and application of lighting. The content and recommendations were developed by the IESNA based on over a century of experience by lighting practitioners throughout North America. The Agency of Education explicit 50 foot-candle requirement is contradictory to the most current IESNA recommendations, may be inappropriate in many situations, and can lead to wasted energy through over lighting.

Efficiency Vermont supports a revision to the regulation that would:

a) maximize energy efficiency according to current IESNA recommendations through professional lighting design;
b) deploy control technologies that adjust light levels based on the type of instruction, the presence of occupants, and the amount of daylight;
c) follow best practices to improve the quality of lighting for the benefit of students and teachers in the classroom

Through our RELIGHT program and project incentives, Efficiency Vermont seeks to provide all Vermont public schools with the opportunity to achieve all three objectives.

Sincerely,

Dan Mellinger, PE LC
Lighting Strategic Planning Manager
Efficiency Vermont

Richard Donnelly
K-12 Schools Strategic Planning Manager
Efficiency Vermont