

Lighting in Schools: Full-Spectrum for Better Health & Productivity?

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SUMMARY:

I plan to conduct three studies to determine if full-spectrum lighting is better than cool-white fluorescent bulbs for students' productivity. Cool-white bulbs are found in the majority of existing schools because of their low cost. I believe that these bulbs are outdated and perhaps should be replaced with bulbs that emit light that is more similar to sunlight. I hypothesize that students will be less hyperactive in an environment that has lighting that is soothing, and this will take attention away from the Attention Deficit Disorder scapegoat. The project is quite small-scale and low budget, but will produce results that are statistically sound and transferable to most educational environments. I plan to compile all of my data and generate a creative work paper that is written in a style that is more colloquial than intimidating academic, and distribute this to the parents of students and to a number of national organizations that deal with education in the United States of America. Ultimately, this is a small-scale research project with a large-scale impact.

RATIONALE:

“Knowledge is power,” said philosopher Sir Francis Bacon in 1597. Knowledge and education, which go hand-in-hand, are tools that are imperative for the excellence of humanity. The current education system in the United States is facing a myriad of problems. The majority of schools in the US have not evolved at the same pace as society has, thus, teachers are contending with a slew of issues concerning the current student demographic that have never before been encountered. Chief among these is Attention Deficit Disorder. This ailment affects 5-20% of school-age children, and is usually recognized by noting “hyperactive behavior in the classroom and an inability to focus for extended periods of time” (“Amphetamine,” n.d.). The most commonly relied upon treatment for this problem has been the prescription of the drug Ritalin. Ritalin is an amphetamine like stimulant, very similar to cocaine, that can be very addictive. It stimulates the central nervous system and produces a temporary ‘calming’ effect that lasts for about three hours. Over 2 million American children, mostly boys, take the drug Ritalin (“Attention Deficit Disorder Facts, Prevention, and Treatment Strategies,” n.d.). It is a dangerously prevalent drug, and as Dr. Allen Buresz pointed out, “In 1996 the World Health Organization warned that Ritalin over-use has reached dangerous proportions. Use of these drugs on a long-term basis is questionable. Safety of such long-term use is simply unknown, but many dangerous side effects have been increasing. Ritalin, for instance, may provoke seizures and suppress growth, or it may cause angina, blood pressure changes, depression or any of a very long list of serious side effects” (Watz, 2005).

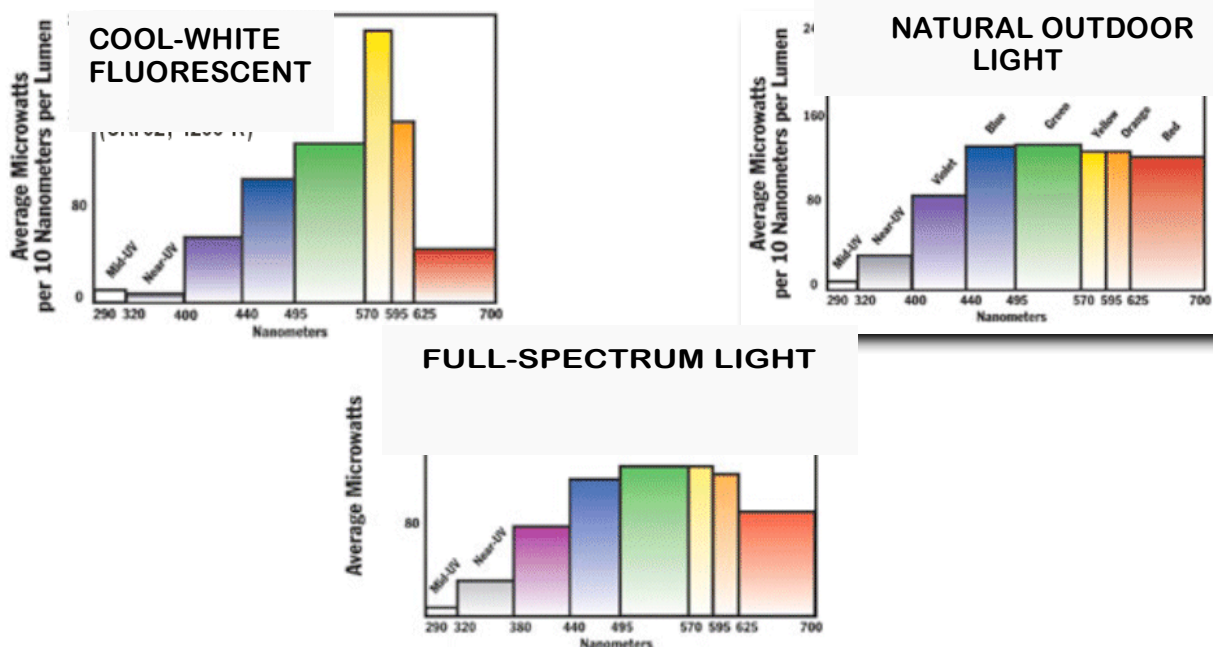
‘Hyperactive behavior and an inability to focus for long periods of time’ can also be caused by environmental factors. Cool-white fluorescent bulbs, which are found in most classrooms, are known to cause bodily stress, anxiety, hyper-activity, attention problems

and other distress leading to poor learning performance (Martel, n.d.). Not enough funding has been given to explore the idea of environmental issues contributing to students' lack of focus, and, instead, prescriptions for Ritalin are written. I believe that the root issue of lighting in classrooms needs to be thoroughly investigated in order to determine if changing the lights in classrooms can reduce the amount of ADD cases diagnosed, and, subsequently lessen the number of students that become reliant on Ritalin. Our Western medical system so often overlooks what could be causing problems, and I think it is essential to drill down to this level to see if there is a better way to alleviate this issue.

I volunteer weekly as a tutor of middle school students for an organization called SMART (Mission Statement, Appendix A). SMART places about sixty students from low-income backgrounds in private and parochial schools. From being a SMART volunteer for five years, I have come to fully understand that kids need their environments to be controlled in order to maximize their productivity. For example, when SMART switches from activity-time to homework-time, they put all the books, games, etc. in the closet of a different room so that they are not visible to the students, thus, lessening the possibility of distraction. I think this can be translated into the idea that all environmental factors in the classroom need to be considered, lighting being one of them.

Facts:

People are supposed to get one hour of natural sunlight per day for optimal health, and this is seldom possible for students that are in the classroom for eight hours a day (Roberts, 2003). The cool-white fluorescent bulbs, found in most classrooms because they are the cheapest to install and have a longer lifespan than most bulbs, give off a disproportionately large quantity of light in the yellow and orange ranges of the spectrum. Therefore, the bulbs often have a harsh glare and are blinding. Natural daylight is more balanced. Full-spectrum fluorescent lighting, created in the early 1970s, was designed to mimic natural outdoor light in its color distribution. It also includes light in the UV part of the spectrum that is required for both physical and mental health.



It seems that if full-spectrum light bulbs replaced cool-white bulbs in the classroom, the health of students could be improved. Harry S. Truman High School in Federal Way, Washington, opened in March 2003 and school officials pushed for the use of full-spectrum bulbs. According to current student Mandi Zentzis, “It makes me feel more active and it makes me get more work done” (Roberts, 2003). This type of benefit for students is the main impetus of my study.

CONTENT DESIGN OF THE PROJECT:

I plan to do two studies in classroom-style settings to determine if full-spectrum lighting is better for students’ productivity and health. I will also conduct one study with a different demographic to see if they have a positive response to the full-spectrum lighting.

TEST 1 - Proposed Methodology:

1. I have already spoken with the SMART organization about using their facilities for one month as a testing site. The SMART space is comprised of two offices, two computer labs, one main room, one kitchen, and one bathroom. It is a pretty small office space and would be an easy place to test the different types of lighting. I will implement full-spectrum fluorescent lighting in one of the computer rooms and in one of the offices. I will keep the existing cool-white fluorescent bulbs in the rest of the facility.
2. I will then prepare three unique tests. They will each test a for different attention factors:
 - a. a Reading Comprehension Test to understand if memory retention is affected by lighting
 - b. a Timed Basic Math Test to gauge if lighting affects the pace of productivity
 - c. an Open-Ended Creative Writing Test to see if lighting influences the creative process (which I believe is related to productivity)
3. I will investigate the students’ profiles and choose four groups of middle school students that seem to be equally matched in academic levels and personal backgrounds.
4. I will administer the three tests to two of the groups in the rooms lit with full-spectrum light. I will also administer the test to two of the groups in the cool-white fluorescent-lit rooms. I will do this on two different days. If I cannot find a statistically significant conclusion from this data, I will still have a few weeks to test again.
5. I will videotape all testing sessions to later review the students’ behavior, noting nervous looking behaviors and looking for abnormal eye blinking behavior.
6. I will analyze my data by grading the Reading Comprehension and the Math Tests on a one point per correct answer scale. I will then derive the average score of each test per room. I will be sure to consider any outlier scores. I will assemble a panel of three adults from different educational backgrounds and professions and have them review the creative writing tests. I will have each grader assign each paper with a 1-10 score (10 being the highest). I will then derive the average in the same manner as above. Then I

will input the data into an Excel spreadsheet to see if the average scores correlate to the different lighting conditions.

7. I will code different actions as types of nervous behavior and then I will analyze the video footage of the three classrooms looking for these things. I will tabulate a score for the nervous behaviors in each classroom.

8. I will watch the video footage and note if any of the students seems to be blinking more in one setting than the other.

9. I will write a creative work paper explaining my results. I will disseminate the report widely to education-oriented organizations that deal with national education policy.

TEST 2 – Proposed Methodology:

1. I will visit Burlingame High School in Burlingame, California. I have a good friend who is a teacher there, so it will be fairly easy for me to use her connections in order to perform a study on their campus. I will speak with the principal and ask for approval to change the lighting in one of the existing classrooms for one week and to later administer a survey to the students involved.

2. I will replace the existing cool-white fluorescent lighting in my friend Amy's classroom for one week with full-spectrum bulbs.

3. I will create a survey asking questions about how the students felt during their 3rd period and 4th period classes. I will ask if recently they have noticed anything different about either classroom. I will also ask if the students think that they get enough time outdoors/sunshine. Most survey answers will be on a 1-10 Likert scale – 10 being the most positive response. Some questions will require open-ended, essay-style answers.

4. I will focus specifically on Amy's 3rd period history class. This class is made-up of thirty-two high school juniors. Most students have a math class fourth period in a classroom that is very similar to Amy's classroom in the way of lighting, layout, etc.. On the Friday after the installation of the full-spectrum lights, I will meet with the students after their 4th period math class. I will distribute the survey to the thirty-two students.

5. I will review the surveys and code the questions with 1-10 style answers on a numeric point scale. I will review the open-ended questions to see if any of the students noticed the changed lighting. I will compile my results in an Excel spreadsheet.

6. I will write-up my results and include them in my creative work paper.

TEST 3- Proposed Methodology:

1. I will select five households of acquaintances and family that I can use for my study. I will find households that have occupants of varying ages, genders, etc. that have not been informed of my project.

2. I will replace the lightning in the entire house with full-spectrum bulbs for one month.

3. I will meet with each household when the month is complete to talk about their thoughts/feelings on the lighting change.

4. I will tape record each interview.

5. I will review my notes and the recordings and write-up a synopsis of my findings to be included in my creative work paper.

I plan to set aside approximately five months to conduct the studies detailed above, and will begin in November 2006. I believe that it will take me one month to secure the full-spectrum lighting for my studies (I hope to work with a specific full-spectrum lighting vendor to get promotional bulbs) and to meet with the SMART director and the Burlingame High School principal to get their approval and square away details. I hope to do the SMART study first. This will be month-two of my project. Following that, I will need two weeks to review the data. I will then conduct the experiment at Burlingame High School. This will require one week of testing, and two weeks to review the data. Lastly, I will conduct the lighting study in the households. This will take one month to do, two weeks for the interviews, and two weeks to review the data.

INSTITUTIONAL CONTEXT:

I have already discussed this project with the SMART organization. They agree with me that most existing classrooms need to be renovated, as they have had the same infrastructure since the 1970s. SMART is very interested in learning about the effects of lighting, and they think that they will make a serious effort to switch their lighting system if it is proven that full-spectrum lighting is better for students. SMART works with ten private schools in San Francisco, and they have promised me that they will distribute my report to these schools. Unfortunately, SMART cannot afford to donate any financial resources to me at this time, though they will try to raise some funds for my work during their next fund-raising push.

My mother is a teacher at La Loma Junior High School in Modesto, CA. She has spoken with her principal and a few colleagues about my project and they are all very excited about my research. They agree that ADD is the scapegoat too frequently. La Loma has offered to let me use their facilities for testing, however I have opted to try to use Burlingame High because of its proximity to San Francisco. All in all, I have conferred with a number of people who are involved in the field of education about my research, and they all believe that this research is crucial and could be very beneficial for future of education.

STAFF + PARTICIPANTS:

I will be the Project Director. I have worked in managerial roles for two different companies and am very skilled at keeping projects on track and on budget. I have a knack for juggling multiple tasks while being very detail oriented (Resume, Appendix B).

I will have a Project Coordinator assist me with my research. This person is not yet hired, but will have experience with analyzing data and with research. Ideally this candidate will be a PhD student who is well versed in academic writing.

I will hire three adults to review the reading comprehension tests from Test One. One individual will be the literature teacher at my mom's high school in Modesto, California. The second person will be my friend Zach Wolf who is a journalist for ABC News in Washington, DC. The last person will be the founder of a local charter school (still TBD).

EVALUATION:

The progress of this project will be easy to measure. If the donation of the full-spectrum light bulbs and the consent of SMART, Burlingame High, and the five households is received, the hardest part is over. The testing should be fairly easy to execute. Collecting the data should also be a straightforward process. This project does not have a lot of room for error, as many research projects do, since it is small scale, yet thorough enough to produce quality results. No similar studies have been done for the past twenty years, so this research will certainly be impactful for the education community. As mentioned previously, if root problems can be identified and solved, all of society benefits.

FOLLOW-UP DISSEMINATION:

I plan to research where full-spectrum lighting can be purchased and to negotiate a deal for people who have seen my report to purchase lighting. I will include the vendor's contact information in my paper.

I will circulate my creative work paper widely in the education community if the results show that full-spectrum lighting is valuable. SMART will assist me with this by distributing my research to their vast network of schools and parents of students. I will also talk with the Dean of San Francisco State personally about the results of my project in hopes that he will make strides toward swapping the existing cool-white fluorescent bulbs that are omnipresent on the San Francisco State Campus with full-spectrum bulbs. I plan to get in contact with the head of public relations of the National Education Association and the California Teachers Association to send both organizations a copy of my research. I will also attempt to set-up presentations of my data at national conferences for principals. Frankly, I am doing this research for changes to be made, not for more academic research to be available in dusty library journals.

If my results show that full-spectrum lighting makes no difference or is worse for people, I will send my report to the National Education Association and ask them to spread the message. I think that this information is still important for people to know.

PROJECT BUDGET:

The budget for this project will be low since it is quite small and I will be using testing facilities for free based on personal connections. Also, the project will only last eight months (five months for testing and three months for creative proposal writing).

(Completed California Endowment Budget Form, Appendix C)

| | | | |
|---|------------------|-----------|-----------------|
| Project Director | 8 mo., 40 hrs/wk | \$20/hr | \$25,600 |
| Project Coordinator | 8 mo., 20 hrs/wk | \$10/hr | \$4,800 |
| Stipend for organizations & households involved | - | \$100/per | \$700 |
| Stipend for readers for Test 1 | | \$20/per | \$60 |
| 50 bound copies of my report | | \$10/per | \$500 |
| TOTAL BUDGET | | | \$31,660 |

There is a chance that I will not succeed at getting the full-spectrum bulbs donated. If so, this increases the total projected budget:

| | |
|---|-----------------|
| TOTAL BUDGET: | \$31,660 |
| +Full-Spectrum Bulbs if donation is not possible: | \$2,000 |
| REVISED TOTAL: | \$33,660 |

APPENDIX:

Appendix A: SMART Mission Statement

Appendix B: Saleema Fazal, Project Director, Resume

Appendix C: The California Endowment Budget Form

Appendix D: Bibliography

Thank you kindly for your time.

Sincerely,

Saleema Fazal

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