*«Original Articles »*

# The Survey of Training Aids and Lighting Effects on Eye Fatigue

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## Abstract

**Background:** One of the valuable experiences that can be useful educational centers is using the various aspects of educational technology and recognition of importance and application training aides in learning process. This study was conducted with the objective of determination of training aids and lighting effects (video projector and white board) on the eye fatigue among students.

**Material and methods:** In this cross-sectional study, students in health and nutrition school (Shiraz University of Medical Sciences) (n=200), voluntarily participated (17-30 years old). A questionnaire consisted of three parts was used as data collecting tool. In the first part, demographic characteristics, in the second part, questions about specific symptoms of eye fatigue and in the third part questions related to the public eye fatigue were included.

**Results:** Results showed that between eye fatigue and the use of video projector and white board there is a significant relationship. Also, results showed that there is relationship between eye fatigue and use of glasses. According to these results, there is no significant relationship between eye fatigue with age and sex.

**Conclusion:**The results showed mean of lighting in classroom in use of video projector is lower than Iran Standard Lighting, but this parameter in use of white board taken in standard limit. Eye fatigue had association with application of video projector and using the glasses.

**Keywords:** eye fatigue, training aids, students

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## Introduction

Visual sense is the most important of sense of the human body. The eyes really are an extension of the brain and a direct link between our environment and our minds. The process of vision begins with visible light- a portion of the radiation spectrum. To good visibility, the lighting (illumination) is required. Generally, human eye is very sensitive system of human body and must protect by an appropriate lighting system (1). Whatever one's job or task is more accurate and delicate; regard to the lighting of working environment is more important (2). Proper lighting enhances the visual efficiency and leads to reducing of the human errors, increasing of efficiency and productivity, improvement of mood, etc (3). On the other hand, lack or excess lighting can cause various problems such as eye strain, tired eyes, headaches, impaired vision, dry and irritated eyes, physical fatigue and psychological effects (4).

Most common eye problem that many people are suffering from it is the eye strain (5). Asthenopia (eye strain) is fatigue or sensation of discomfort and pain inside or around the eyes that different factors such as refractive disorders, muscle or accommodative insufficiency can cause incidence of its. This disease is sometimes accompanied with symptoms such as eye strain, blurred vision, acute double vision, headache and some of the environmental factors (including light intensity and position, subject position against of goods and distance of subject from goods) (6).

Lighting is one of the structural components of classroom and also can effective on learning in academic environments (7). In high demand visual task (such as classroom) that the eye is focused on a constant distance for a long time, eye muscles become fatigue and spasms (8-10). In general, in the learning process, 83% of learning takes place through the visual sense, therefore if seeing activity be faced with difficulties, a decrease in the learning occurs (11).

As observe the faculties of university used from various methods for education of scientific information to students. In this context, the electronic and non-electronic educational aids can help for better learning. With regard of perception and incarnation ability of students, can use to learning equipments such as blackboard, whiteboard, video projector, atlas and photos, model, film, etc.

Nowadays professors in more classrooms are use from educational aids including video projector, overhead and so on. Mechanism of function in these devices is different. This study was conducted with the objective of determination of training aids and lighting effects (video projector and white board) on the eye fatigue among students.

## Material and Methods

In this cross-sectional study, all of the students in health and nutrition school (Shiraz University of Medical Sciences) in educational year of 90-91 voluntarily participated (n=200). These subjects were occupied with theory courses and were used video projector and whiteboard. Number of hours that students were present in which class, was 2 hour.

***Data collection tools:***

***1) Questionnaire:*** An anonymous self-administered questionnaire was used to collect the required data from each subject. Reliability and validity of this questionnaire is approved by three professors of occupational health (Shiraz University of Medical Sciences) and the statistical consultant. Cronbach's alpha by statistical consultant 0.86 was calculated. This questionnaire consisted of 3 parts:

**a)** Demographic and personal details (age, sex, eye problems, using the glasses, etc.) and also characteristics of classes (measures of lighting, lighting conditions, etc.).

**b)** The second part of this questionnaire is including of 23 specific symptoms of eye strain (12). The subjects whenever looks

long-term to screen of video projector and whiteboard and exposed to diverse eye strain, the related item (never, sometimes, often and always) in this questionnaire is marked. Likert scale used to for scoring of this questionnaire items.

The lowest score was 23 that is related to category of "never". Subjects who take in this category didn't have any of the symptoms of eye strain. Those who take in the range of 24 to 46 had shown few symptoms of eye strain (sometimes). Those who take in the range of 47 to 69 had shown more symptoms of eye strain than the 2 previous groups (often). Subjects who take in the range of 70 to 92 suffer from severe eye strain and had shown most symptoms of eye strain (always).

**c)** The third section of this questionnaire included questions about the general eye strain (12).

***2) Measurement of lighting:*** Lighting was measured using the luxmeter Lutron lx-101 model. For measurement of lighting was used from method of regular or continuous lamps connected in two or more rows (13) and lighting was calculate in 2 status including *1)* using the video projector and *2)* using the whiteboard. It should be noted that the measurement of lighting in all classrooms was done at 10-12 am.

***Data analysis:***

Data were analyzed using statistical tests including Pearson Correlation, Kruskal-Wallis and Mann-Whitney U by SPSS software (Version 16.0).

## Results

The demographic features and some symptoms of eye fatigue in the studied subjects are presented in Table 1.

Mean, standard deviation and minimum and maximum of light intensity in the classrooms of the School of Health and Nutrition, Shiraz University of Medical Sciences while using video projector and whiteboard are presented in Table 2.

Table 3 shows the number and percentage of the individuals with eye fatigue while using video projector or whiteboard. Also, the mean score of eye fatigue while using video projector or whiteboard has been compared in the studied students.

The results of Pearson correlation test showed that the correlation coefficient (r) between the subjects' age and score of eye fatigue resulting from video projector and whiteboard were 0.123 ($P>0.05$) and 0.207 ($P>0.05$), respectively. This shows that no significant relationship was there between age and eye fatigue resulting from video projector and whiteboard.

In Table 4, eye fatigue score has been compared among the study subjects based on the field of study, sex, and using eye glasses and by taking the type of training aids into account.

**Table 1. Some personal details of the students participating in the study (n=200).**

| | | |
|---|---|---|
| Age (yrs): | Mean (SD) | 21.20 (1.82) |
| | Min–Max | 17-30 |
| Sex: | Male | 45 (22.5%) |
| | Female | 155 (77.5%) |
| Educational field: | Occupational health | 80 (40%) |
| | Environmental health | 40 (20%) |
| | Public health | 30 (15%) |
| | Nutrition | 50 (25%) |
| Use of glasses: | Yes | 83 (41.5%) |
| | No | 117 (58.5%) |
| Quality of lighting: | Proper | 123 (61.5%) |
| | Improper | 77 (38.5%) |
| Quantity of lighting: | Proper | 130 (65%) |
| | Improper | 70 (35%) |
| Referred to physician: | Yes | 118 (58.4%) |
| | No | 82 (41.6%) |
| Type of eye disorders: | Reflective Fault | 70 (35%) |
| | Glaucoma | 1 (0.5%) |
| | Cataract | 3 (1.5%) |
| | Corneal damages | 9 (4.5%) |
| | Retinal damage | 0 (0%) |

**Tale 2. Lighting in classroom in health and nutrition school**

| Lighting (lux) | Mean (SD) | Min-Max | Standard in Iran |
|---|---|---|---|
| Using the video projector | 161.44 (12.7) | 40-294 | 300-500 |
| Using the whiteboard | 425.38 (13.9) | 297-677 | |

**Table 3. The frequency of subjects based on the eye strain and compare of mean of eye strain score in using the video projector and whiteboard among students (n=200).**

| Type of training Aids | eye strain score | | | | Mean (SD) | p-value[§] |
|---|---|---|---|---|---|---|
| | 23[*] No. (%) | 24-46[**] No. (%) | 47-69[†] No. (%) | 70-92[††] No. (%) | | |
| Video projector | 0 (0%) | 135 (67.5%) | 62 (31%) | 3 (1.5%) | 44.25 (8.56) | <0.01 |
| Whiteboard | 12 (6%) | 186 (93%) | 2 (1%) | 0 (0%) | 30.63 (4.81) | |

[*]never, [**] sometimes, [†]often, [††]always

[§]Mann-Whitney U

[*,†]p-value<0.05 (Mann-Whitney U)

**Table 4. Compare of mean of eye strain score based on educational field, sex and using the glasses in using the video projector and whiteboard in students (n=200.)**

| Variables | | eye strain score | |
|---|---|---|---|
| | | video projector | whiteboard |
| | | Mean (SD) | Mean (SD) |
| Educational field: | Occupational health (n=80) | 43.32 (8.21) | 30.73 (4.07) |
| | Environmental health (n=40) | 44.65 (6.11) | 30.95 (3.77) |
| | Public health (n=30) | 43.18 (7.43) | 30.55 (4.02) |
| | Nutrition (n=50) | 44.95 (6.71) | 30.02 (3.89) |
| Sex: | Male (n=45) | 46.26 (7.02) | 31.42 (3.56) |
| | Female (n=155) | 43.67 (6.35) | 30.40 (3.69) |
| Use of the glasses: | Yes (n=83) | 46.10 (6.76)* | 31.71 (4.11)[†] |
| | No (n=117) | 42.88 (7.83)* | 29.87 (7.83)[†] |

## Discussion

The present study was conducted on a young population with the mean age of 21.2 years. Most of the study participants (77.5%) were female and all subjects were B.Sc. students.

The study findings showed that the mean light intensity of the classroom was below Iran's standard brightness when using a video projector, but within the standard range when making use of a whiteboard (14).

According to the results, using both video projector and whiteboard led to eye fatigue in the studied students; of course, the intensity of eye fatigue resulting from using the video projector was higher than that of whiteboard ($P<0.01$). This might be due to the high brightness of the video projector's monitor and low brightness of the classroom which lead the students to stare at the board. Yet, another reason might be the low contrast between the background and the font color. In fact, due to the darkness of the environment, the students have to stare at the monitor all the time which leads to eye muscles fatigue.

The findings of the current study revealed no significant relationship between eye fatigue and age as well as sex ($P>0.05$), which is in line with the studies conducted by Arnaud et al. and Rajnarayan et al. (6,13).

On the other hand, a significant relationship was observed between using eye glasses and eye fatigue resulting from video projector ($P=0.024$) and whiteboard ($P=0.002$), which is in agreement with the previous studies performed on the issue (15).

In this study, eye fatigue was determined through self-report. Therefore, further studies are recommended to make use of special devices for assessing eye fatigue and compare the results with those of the present study. In Conclusion Since eye fatigue can be highly effective in the individuals' learning process, identifying the factors affecting the students' eye fatigue in classrooms is of great importance. According to the findings of this study, using video projector and eye glasses affect eye fatigue.

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