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A Survey on the Application of Educational Lighting Board as an Educational Aid Tool of Occupational Health Students

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Abstract

Background & Objective: Lighting lessons is necessary for the occupational health students. Educational aids are essential in promotion of learning. This study aims to evaluate students' learning in practical part of lighting lesson by using educational resources of lighting boards.

Materials and Methods: In a quasi-experimental study that was carried out on occupational health students of North Khorasan University of Medical Sciences. The samples were divided into case and control groups. Each group consists of 40 participants. The control group was trained in the traditional method and the case group was trained using the educational board. In addition to students' feedback, students' scores were also judged to assess learning. The scores in both groups were analyzed by SPSS 19 software.

Results: 25% (n = 20) of students were male and 75% (n = 60) were female. With the use of educational boards, learning speed, retention of skills, ease of understanding and motivation increased by 85%, 90%, 90% and 95%, respectively. The mean score was 17.75 ± 1.75 in case group and 15.5 ± 2.15 in control group. The mean difference in acquired scores was significant between the case and control groups.

Conclusion: The occupational health students' learning improved with the use of educational boards. According to the results of the students' comments, this tool can be used as a useful educational tool in presenting this lesson.

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Introduction

The university is considered the primary platform for human development, and the higher education system is highly responsible for training specialized and efficient human resources (1, 2). Today, the capabilities of individuals have been increasingly recognized by institutions and organizations, therefore, due to the impact of individuals on the health status of society, the importance of human resources in healthcare institutions and organizations is undeniable. Medical universities are responsible for training human resources that promote health status (3, 4). Therefore, designing and using efficient and effective educational systems in universities is of particular importance. Occupational safety and health (OSH) are among the disciplines of medical sciences, which is chiefly responsible for identifying light sources and measuring the amount of light in the workplace. The inadequate light intensity of workplace forces the workers to increase the pressure on the muscles of the visual system which results in muscular stiffness, discomfort and pain in above the eye socket, and presbyopia (5).

A proper lighting system can play an essential role in protecting the human eye. According to studies, even a healthy visual system may experience adverse physiological, neurological and psychological disorders with an unsuitable lighting system (6). Application of new educational methods such as teaching aids (TAs) is one of the main factors in the education process (7, 8). TAs refers to all tools, equipment and facilities that can create conditions in the educational environment that make learning faster, easier, better, more sustainable and effective

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(9). TAs aims to save education time, make communication easier and establish a better understanding between teacher and student (10).

TAs are used for other purposes such as workplace simulation (11), industrial control processes (12), pharmaceutical (13, 14), exposure of laboratory animals to particles of respiratory diseases (15, 16), pollutant simulation (18, 19), and preparation of samples for chemical analysis (17). Therefore, installing educational boards inside the laboratory can facilitate the training of practical courses (9, 10).

Accordingly, OSH professionals can have a correct and appropriate assessment of the lighting situation of the workplace with sufficient knowledge, so if necessary, they can take the required measures to protect workers. Workplace lighting is one of the specialized courses for students of OSH, which is presented in two parts: theoretical and practical. Faculty of Health of North Khorasan University of Medical Sciences held OSH course in every semester.

In ideal conditions and if all facilities including sufficient laboratory space, test equipment and equipment and sufficient time are available, the professor can teach different lighting system equipment, types of lighting sources, how light sources work, communication mechanism between types of equipment in the designed system, how to set up lighting systems, and how to test photoelectric sensors to the students. However, due to the limitations such as equipment unavailability, lack of time and lack of sufficient experience of students, students cannot get acquainted with the types and specifications of real examples of light sources at the time of this course. Therefore most of them graduate without sufficient ability to recognize the types and characteristics of light sources. Given that there was no study conducted on the application of familiarity education system with light sources, the researchers of this university designed and built a laboratory TA, which was used to promote practical training in the laboratory. Since this system was used for the first time, therefore this study aims to investigate the effect of this TA in improving the educational level of students in OSH course.

Materials and Methods

This quasi-experimental intervention study was conducted in 2019. The population comprised of online and offline undergraduate students of OSH at the Faculty of Healthcare of North Khorasan University of Medical Sciences. The subjects were divided into two control and intervention groups; each consisted of 40 samples. The control group contained students whose practical lessons were taught by lecture, and traditionally before the formation of the educational board, the intervention group included all students whose practical lessons were taught by using the educational board.

The same professor taught both groups so that learners had the least impact on each other. Through the executive stages, the educational system was designed and built after conducting extensive studies and presenting an innovative plan based on the educational topic of the workplace lighting course. So that students with different lighting system equipment (including switches, wrenches, fuses, transformers, ballasts), various types of lighting sources (including fluorescent lamps, incandescent, mercury gas, sodium gas, metal halide), the performance of the light sources, the communication mechanism between the equipment in the designed system, setting up and operating the lighting systems, and how to test the photoelectric sensors.

Students were initially acquainted with the general principles of this course, but due to the limitations of the traditional method where the student could not perform the actual test, steps were taken that students could get acquainted with equipment and lighting sources in this educational system at the presence of the teacher. After completing the training course, the score of various sections was identified in intervention and control groups in order to determine the efficiency of this TA

system in promoting practical training of lighting lessons in the workplace as well as evaluation of its content.

Data were collected by providing the students of the intervention group with a self-reported questionnaire that evaluated their learning ability of motor psychology and their satisfaction with this teaching method. This questionnaire was in line with the study of Fallah et al. in 2013 (19). The content validity of the questionnaire was assessed and confirmed by experts, and Cronbach's alpha test confirmed its reliability with a range higher than 0.7. The questionnaire comprised seven items with three scoring scales of "I disagree, I have no opinion, and I agree". Students designed the final segment of the questionnaire as two open-ended questions regarding the expression of suggestions and the strengths and weaknesses of the course presentation using this TA tool. After the students were told face-to-face about the study objectives, questionnaires were given to them, and they completed them. Individuals were free to participate or not to participate in the study. Data were analyzed by SPSS software version 19, and descriptive statistics presented the results, distribution tables and frequency percentage, mean calculation tables and standard deviation (SD), and the correlation of the data was determined by T-test.

The results of this study are extracted from the technological plan approved by Bojnurd University of Medical Sciences with research code of "1250 P 98" and the ethics code of "IR.NKUMS.REC.1398.080" (fig 1).



Fig 1: Educational board for familiarity with light sources

Results

Since the survey was delivered to students immediately after the practical test, all them completed the questionnaires and submitted them to the author. Analysis of the results from the

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questionnaire indicated that 25% of the students (20 individuals) were men, and 75% of them (60 individuals) were women.

The results of a self-reported questionnaire that measured students' learning in the field of motor psychology against the traditional method (lecture) indicated that 85% of students expressed higher learning speed and progress of this method, 90% of students considered the durability of the learned skill and the ease of understanding the material learned with TA more than the traditional method of education.

80% of students consider the quality of the material learned with educational board more than the traditional method, and also according to students, educational board method increased their motivation by 95% and reduced workload by 90% (Table 1).

Table 1: Students learn from practical training using educational board

Questions	students response (%)		
	disagree	agree	No opinion
The speed of learning the skill in this method is better	0	85	15
The durability of the skills learned with this method is longer	0	90	10
It is easier to understand what is learned in this method	2.5	90	7.5
Teaching style stimulates practical work in the student	0	95	5
The volume of work using the educational board is high	90	2.5	7.5
I think this method has made good progress in learning	7.5	85	7.5
The quality of the material learned with this educational board is higher than the traditional method	2.5	80	17.5

The results of the analysis of students 'evaluation score on equipment and various sources of lighting system for both control and intervention groups indicated following results: the mean score of the intervention and control group were 17.1±75.75 and 15.2±5.15, respectively. Due to the normal distribution of data based on the T-test, the mean score among the two groups was significantly different (p-value=0.003) (Table 2).

Table 2: Factor loads and variance for each item

Variable	group	Mean	standard deviation	P-value
Score	Case	17.75	1.75	0.003
	Control	15.5	2.15	0.003

According to the survey, the strong points of using the educational board compared to the traditional method included better learning, get utterly familiar with equipment and lighting sources inside the laboratory, the tangibility of the content during presentation time, the practicality of the class,

experimenting the learning material by the student, and more accessible learning.

The weak points of using the educational board compared to the traditional method included more crowded classroom and the fewer number of sessions. Table 3 presents the suggestion of students regarding the performance and classroom improvements for the educational board method.

Table 3: Goodness-of-Fit Indices for the First Order CFA

R	Suggestions
1	Increase the number of sessions and use duration of educational board
2	Upgrade training tools and add more features
3	Classes of the practical part of this course should be held with smaller groups of students
4	Design and make such tools for use in providing other practical lessons
5	Immediately after the end of each taught subject, use of educational board

Discussion

This study examined the impact of using a TA tool on practical learning of the workplace lighting course in which assessment of students' opinions was a critical factor that TAs will make the learning more comfortable and faster (20).

The study of Khaghanizadeh et al. (2009) entitled using educational media and coeducational instruments in teaching, indicated that the if associated with the activity and participation of learners, TAs only boost the learning but also increases the depth of taught material (9). Moreover, It was concluded that the richer the use of teaching aids, the more comfortable and shorter the learning and teaching would become (21). The provided content is consistent with the definition of TA equipment; therefore it refers to all devices and facilities that can create conditions in educational environments for faster, easier, better, more sustainable and effective learning (22).

The practical score of the intervention group was significantly higher than the control. The results of this study were consistent with the study of Fallah et al. (2013) (19) in Yazd University of Medical Sciences regarding the design and construction of a production and simulation chamber for airborne pollutants and study of Najafi et al. In (2011) (23) in Tabriz University of Medical Sciences regarding applying computerized simulations in teaching pharmacology.

Learning is the acquisition of knowledge, skills and its application in the real world environments (24). According to studies, utilizing TAs will make the learning environment more favorable and motivational, which was in line with the findings of this study (25). One of the reasons for improved learning with TAs can be attributed to the sense of vision as the dominate perception method. According to the studies, different senses play various roles in human learning; therefore the rate of learning by sight, hearing, touch, smell and taste are 75%, 13%, 6%, 3% and 3%, respectively (9). In traditional teaching methods, students rely on memorization of materials rather than their perception and application (26).

Since the primary mission of medical universities is to train graduates to promote community healthcare (26), the OSH engineering which focuses on identification, evaluation and controlling harmful factors in the workplace, is a critical discipline of medical sciences and social healthcare. Due to the educational limitations and shortcomings, fulfilling

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the educational goals faster and more comfortable by using new methods and Tas is crucial (27). If learners are provided with extensive educational facilities, they will outperform those who have experienced a more unfavorable environment (28).

Strong and sufficient motivation will improve learning and promote a desirable behavior in students (29) Therefore, by using a new educational method such as TAs and sustainability of the materials, learning motivation has been boosted which was consistent with the results of this study (17).

Given the small population size and its restriction to only one specific faculty, it is advised that similar studies be conducted in larger populations and a larger number of medical universities across the country. Besides, conducting this survey immediately after the final exams could have reduced freedom of participation.

Conclusion

The learning of students in the practical part of the lighting course was increased by using the educational board, according to the student opinions, this can be a useful TA for presenting this course.

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Conflicts of Interest: The authors declare that there are no conflicts of interest.

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