DOI Number: 10.5958/0976-5506.2019.03101.2

Effect of Computer Related Ergonomics Intervention on Knowledge and Practice of Primary School Children

Lamiaa Saad Abdallah[1], Nagah Mahmoud Abdou[2], Afaf Ibrahim Abd Elrehim[3]

[1]Assistant Lecturer, [2]Professor, [3]Assistant Professor, Community Health Nursing, Faculty of Nursing, Cairo University, Egypt

ABSTRACT

Improper use of computers results in a variety of health disorders. The cumulative effect of this technology-induced, sedentary lifestyle leads to poor posture, pain, repetitive strain injury and dysfunctional movement patterns. Aim: assess the effect of computer ergonomics educational intervention on knowledge and practice of primary school children. Design**:** Quasi – experimental design. Sample: A total of 100 primary school children were randomly selected. Data were collected using Children Knowledge Assessment Questionnaire, Computer Workstation Assessment Checklist, Children Ergonomics Observational Checklist. Results: This study revealed an increase in knowledge and practice mean scores in immediate and follow up post intervention scores compared to pre intervention mean scores. As well, statistically significant differences were found between total knowledge and total practice scores regarding computer ergonomics in pre, immediate post and follow up the intervention. Conclusion: The educational intervention is effective in improving the children knowledge and practice. Therefore, it is recommended to replicate the research on a large sample and in different settings to achieve more generalization.

Keywords: *Ergonomics, Computer use, knowledge and practices, Primary school children.*

Introduction

The use of computers in schools is now well established worldwide and strategies to increase the level of use of computers by children are ongoing. However, there continues to be little thought given to ergonomic factors during the setting up of computer workstations in schools or to the subsequent use of the computers by the children. On the other hand, long periods of using a computer can increase chance of developing musculoskeletal problems. Inappropriate posture during computer use can cause muscle and joint pain, overuse injuries of the shoulder, arm, wrist or hand, and eyestrain[1].

The effect of improper ergonomics manifests even before students reach graduation, hence the need for commencing educational and ergonomic interventions from undergraduate years or even earlier[2].So, building up of school children knowledge and skills regarding ergonomics must be emphasized during these years [3]. Proper educational intervention is expected to improve the knowledge and practice of ergonomic principles, which is assumed to reduce the associated health risks [4].

Ergonomics is the science that seeks to comfort the work station and all of its physiological aspects to human [5]. Ergonomics is about fit: the fit between people, the things they do, the objects they use and the environments they work, travel and play in. If good fit is achieved, the stresses on people are reduced. So they are more comfortable, can do things more quickly and easily, make fewer mistakes and get injured less frequently[6].

Hypotheses:

H1: The posttest- mean knowledge scores of children who were exposed to ergonomics educational intervention will be higher than pretest –mean knowledge scores.

H2: The posttest - mean practice scores of children who were exposed to ergonomics educational intervention will be higher than pretest –mean practice scores.

Corresponding Author:
Lamiaa Saad Abdallah
Assistant Lecturer, Community Health Nursing
Faculty of Nursing, Cairo University, Egypt
Phone: 0106720603
Email: lamia_adham@yahoo.com

Materials and Method

After the random selection of a three primary governmental school from the available educational governmental sectors in Cairo governorate, one classes from every school was randomly selected from the list of 4th grade classes. The sample size as calculated by power analysis[7] was 100 children. Fourth grade children were selected in particular as preadolescence was an appropriate age for the implementation of educational program to avoid musculoskeletal problems which are more prevalent during adolescence.

Exclusion Criteria: Students with previous surgeries, deformities in the musculoskeletal system or rheumatoid arthritis were excluded.

Data Collection Tools:

I: Children Ergonomics Knowledge Questionnaire: It was used to assess children knowledge regarding computer use ergonomics**.** For each yes or no question, a correct answer was scored 1 and 0 score for the incorrect one.

II: Computer Workstation Assessment Checklist: It was used to assess computer workstation and related ergonomic risks. The checklist had a total score of 40. A score of 40 indicated the best score as each item fulfilling the standards was given 1 score and if not was given zero.

III: Children Ergonomics Observational Checklist: It was used to assess children practices of ergonomics while using computer in the computer workstation. For each item, children were scored 2 if they adopted proper ergonomics and 1 if they did not.

Content validity was done and tools were tested for internal consistency (Cronbach's alpha was 0.87).

Procedure: An approval was obtained from Research Ethics Committee at Faculty of Nursing, Cairo University. Official permissions were obtained from the related administrations of schools to conduct the proposed study.

Children were asked to participate in the study and the researcher explained the aim of the study to all students. Also, written consent was obtained from the parents before children were enrolled in the study. Oral consent was obtained from the children to participate in the study.

The study was carried out on four phases: assessment phase, planning, implementation and evaluation phases.

1. **Assessment Phase:** In this phase, assessment of children ergonomics knowledge was done using tool I. Also, assessment of computer workstation by using tool II. As well, the researcher observed the children in the computer lab using tool III.
2. **Planning Phase:** The researcher designed the educational intervention. The aim of this educational intervention was to provide children with knowledge and skills of ergonomics principles and to promote behaviors that encourage a healthy musculoskeletal system. The program included knowledge about anatomy and structure of spine; ergonomic science, human body mechanics, solution of obstacles of following ergonomics principles, and stretch exercises for prevention of musculoskeletal health problem.
3. **Implementation Phase:** The designed intervention was presented in simple Arabic language. The designed intervention was carried out on five sessions, each session was given in the form of teaching class through pre – designed training materials.

   Pamphlets, flyers, and a compact disc with a short documentary video was used. Demonstration on the proper ergonomics principles, as well, stretching and strengthening exercises were done. Handouts were given for the children. Feedback was given at the end of each session.
4. **Evaluation Phase:** Immediate evaluation of the educational program was done using tool I and tool III to assess the achievement of intervention objectives and three months later to ensure stability of knowledge and practice.

Results

Concerning knowledge of children regarding computer use ergonomics table (1) shows that, it was improved in immediate and follow up post tests compared to pre test.

Table 1: Percentage distribution of pre, post and follow up knowledge of children regarding computer use ergonomics (N = 100)

Knowledge of computer use ergonomics	Pre-test	Immediate post -test	Follow up post -test
Hours per day			
1 - 2 hours (correct answer)	51	74	60
3- 4 hours	21	7	15
5 - 6 hours	19	8	11
6 + hour	9	11	14
Distance between monitor and children eye			
Correct	39	86	82
Incorrect	61	14	18
Rest period after prolonged sitting			
Every two minutes	27	15	25
Every twenty minutes (correct answer)	20	73	55
Every hour	23	4	10
Feeling a need for rest	30	8	10
Body part needs support while sitting on computer chair			
Shoulder and neck	31	10	32
Lower back (correct answer)	45	47	22
Middle of the back	24	43	46
The correct body posture			
Correct	24	71	65
Incorrect	76	29	35
Proper elbow position when keying			
Correct	58	92	79
Incorrect	42	8	21

Concerning knowledge of children regarding methods of preventing computer ergonomics risk factors table (2) shows that, it was improved in immediate and follow up post tests. The percentage of correct responses in the pre test ranged between 10% - 57% increased to 63% - 72% in immediate post test and 51% - 69% in follow up post test.

Table 2: Percentage distribution of pre, post and follow up knowledge of children regarding methods of preventing computer ergonomics risk factors (N = 100)

Preventing computer ergonomics risk factors	Pre-test	Immediate post-test	Follow up post -test
After prolonged sitting put a pillow			
Above shoulder	32	12	21
Below lower back	57	72	69
Under feet	11	16	10
To prevent eye discomfort:			
Increase the brightness of the room	40	14	15
Increase the brightness of display screen	31	23	26
Maintain arm distance between monitor and body (correct answer)	29	63	59

Conted…

To reduce glare on computer screen			
Don't look at the screen	30	10	14
Do not use the computer	30	3	16
Adjust the screen brightness on your computer to low	30	16	19
Close the curtains (Correct answer)	10	71	51

Table (3) shows that, body posture ergonomics practice for computer use improved in immediate and follow up post tests compared to pre test.

Table 3: Percentage distribution of pre, post and follow up practice of children regarding ergonomics of body posture during computer use (N = 100)

Body posture during computer use	Pre test		Immediate post-test		Follow up post-test	
	Yes	No	Yes	No	Yes	No
	%	%	%	%	%	%
The back is straight and well supported by chair	12	88	74	26	74	26
The feet is flat on the floor	20	80	59	41	50	50
The knees and hips are at 90 degrees when sitting	12	88	84	16	68	32
The elbows are at 90 degrees to the body while typing	16	84	94	6	87	13
Wrists are straight (not bent up or down) when typing	27	73	92	8	76	24

Table (4) illustrates a highly statistically significant differences between knowledge and practice scores among children in pre, immediate and follow up post tests (P value = 0.000). This table covered first and second research hypotheses.

Table 4: Difference between the mean scores of knowledge and practice in pre, post and follow up tests (N = 100)

Knowledge	Max	Pre-test		Immediate post-test		Follow up post-test		F	p
		Mean	Std.	Mean	Std.	Mean	Std.		
Total knowledge	55	27.281	4.74312	42.1300	7.51383	40.420	8.29407	95.514	.000*
Total practice	110	69.960	6.1839	101.6000	5.73488	97.2600	6.67215	83.790	.000*

*The mean difference is significant at the 0.05 level

Table (5) indicates highly statistically significant positive correlations between children's total computer knowledge score and total computer practice scores in pre test and follow up post tests (p =, 000 & p =, 002 respectively).

Table 5: Correlation between children's total computer ergonomics knowledge and practice scores in pre, immediate and follow up post tests (N = 100)

Knowledge / Computer ergonomics	Pre computer use practice score		Post computer use practice score		Follow up computer use practice score	
	R	P	R	P	R	P
Pre computer use knowledge score	.598**	.000				
Post computer use knowledge score			.051	.613		
Follow up computer use knowledge score					. 300**	.002

Table (6) shows that, the three schools didn't have the acceptable level for computer workstation designs**.**

Table 6: Distribution of pre test scores of computer workstation (N = 3)

Computer workstations in studied schools				
School (A)	**School (B)**	**School (C)**	**Min score**	**Max score**
14 (35%)	25 (62.5%)	19 (47.5%)	0 (0%)	40

Discussion

Regarding children's knowledge of computer use ergonomics the current study revealed that, the correct responses were increased in immediate and follow up post tests. These results were in harmony with a study done to investigate the awareness and practice of computer ergonomics among students in Ajman and found that, students who were exposed to ergonomics intervention identified the correct viewing distance, used ergonomic key boards and also take frequent breaks when compared to students who were not exposed to ergonomics intervention [8]. These results highlighted the importance of integrating ergonomics educational program in schools as proper educational intervention is expected to improve the knowledge and practice of ergonomic principles, which is assumed to reduce the associated health risks.

Also, the study results were consistent with a study conducted to assess knowledge of computer ergonomics and incidence of musculoskeletal disorders among 120 students in India and indicated that more than half of children considered that an elbow angle of 90 is essential. As well, three quarter of children mentioned use of backrest to support lower back and feet should rest comfortably on the floor or on a footrest [9]. These results may be due to effect of ergonomics educational intervention that enhanced knowledge regarding the proper use of computers, especially when the focus of these interventions has been on overall postural health, environmental ergonomics and body mechanics.

Concerning children's knowledge about methods of preventing computer ergonomics risk factors the current study showed, improvement in immediate and follow up post tests. These results were supported by the results of a study conducted by Bisht & Bakhshi [9]. Students of their study stating that arm rests, back support and using antiglare screen of computer were very important. Also, distance of arm length from screen is essential. This improvement may be due to ergonomic educational intervention that helped the student remember the ergonomic information presented in the educational intervention and easily answer questions correctly at the first and second assessment.

Regarding body posture ergonomics during computer use, the current study revealed that it was improved in immediate and follow up post tests. Theses results were contradicted with the study conducted to assess computer-related posture and musculoskeletal discomfort in schoolchildren and revealed that no student was found to have an acceptable posture while working at the computer. The majority of student's postures were inappropriate indicating that further investigation and intervention is required[1]. The positive effect of educational sessions in the current study could have played role in promoting changes in computer use ergonomics and it reflected adherence to the intervention program.

Regarding computer workstation assessment for the three governmental schools and its related ergonomic risks, the study showed that, the three schools didn't have the acceptable level for computer workstation. This result was consistent with a study conducted to investigate how computers are being used in schools of Mumbai, computer workstations and the posture adopted by students [10]. The study showed mismatch between the students' dimensions and furniture dimensions in computer labs and computer workstation were inadequate for majority of the students. That result reflected lack of ergonomics consideration while designing computer labs may be due to financial difficulties of the educational facilities at governmental schools.

The current study indicated, highly statistically significant positive correlations between children's total computer knowledge score and total computer practice scores in pre test and follow up post tests (p =, 000 & p =, 002 respectively). These results contradicted with a study conducted by Shantakumari et al [9]who found that attendees of ergonomics training workshop didn't put the principles learned into practice before and after the workshop.

According to learning theories, access to information and knowledge is the starting point in learning process and retention of knowledge thus enhance behavior. According to this logic, improvement in students' knowledge lead also to improvement in their practices.

Conclusion

The ergonomics educational intervention had significant positive effect on children' knowledge and practices which were evident by statistical increase in their knowledge and practice mean scores in immediate and follow up post intervention compared to pre intervention mean scores. So the research hypotheses were accepted.

The study recommended the following:

- Replication of the research on a large probability sample to achieve more generalization.
- Endorse ergonomics educational intervention in the school curriculum.
- Health instructional program that encourage healthful postural habits for school children should be intensified at schools.
- Reinforcement of ergonomics consideration while designing computer workstations at schools tools or equipment used by children.
- Ergonomics intervention in form of students education and computer workstation adjustment may provide solutions to ergonomics risk factor presented in governmental schools.

Ethical Clearance: A witten approval was obtained from the Research Ethics Committee of the Faculty of Nursing - Cairo University. Written informed consent was obtained from each participant after explaining the nature & purpose of the study. Participants were informed that participation in the study was entirely voluntary, anonymity and confidentiality of the data were assured.

Source of Funding: Self-funding.

Conflict of Interest: The authors declare that there is no conflict of interest.

REFERENCES

1. Dockrell S, Earle D, Galvin R. Computer-related posture and discomfort in primary school children: The effects of a school-based ergonomic intervention. Computers & Education 55 (2017) 276–284. doi: 10.11648/j.ajns.20170603.
2. Schlossberg EB, Morrow S, Llosa, A E, et al. Upper extremity pain and computer use among engineering graduate students. UC San: Francisco; 2012. Available from: URL : http://escholarship.org/uc/item/1x49r213.
3. El-Nagar, S.A. & Mady, M. School bag usage, postural and behavioral habits and its effect on back pain occurrence among school children, Faculty of Nursing, Menoufia University, Shebin El-Kom, Egypt. *American Journal of Nursing Science* 2017; 6(3): 218-231.http://www.sciencepublishinggroup.com/j/ajnsdoi: 10.11648/j.ajns.20170603.
4. Hultman G, Nordin M, Ortengren R. The influence of a preventive educational programme on trunk flexion in janitors. Appl Ergon 2012; 15(2)127-33.
5. Hedge A. Ergonomics workplace design for health, wellness, and productivity (7th ed). London: Taylor & Francis 2016.
6. Occupational Health and Safety (OHS). Ergonomics for schools Centre for Occupational Health and Safety, "OSH Answers. Available at:www.ccohs.ca/oshanswers/U.K. Ergonomics Society, "Ergonomics for schools", 2015.
7. Ellis D. The Essential Guide to Effect Sizes: An Introduction to Statistical Power, Meta-Analysis and the Interpretation of Research Results. United Kingdom: Cambridge University Press,2010.
8. Shantakumari N, Eldeeb R.A, Sreedharan J, Gopal, K. GMJ, 4th Annual Scientific Meeting of Gulf Medical University Poster Proceedings. Pp: 11-14.GULF MEDICAL JOURNAL ASM 2012;1(S2):S11-S14
9. Bisht D, Bakhshi B. Knowledge of computer ergonomics and incidence of musculoskeletal disorders among students of Punjab Agricultural University, Ludhiana, India. Journal of Applied and Natural Science 10(1): 323 - 329 (2018).
10. Patel P. Postural Assessment of Primary School Children working on Computers and the associated risk International journal of English language, literature and humanistic. Volume III issue III MAY 2015- ISSN 2321-7056.