

An Investigation into Learners' Perceptions of Ergonomics in the Classrooms at school of Physical Education and Sports

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Abstract: The present study was carried out on 183 volunteer students studying at School of Physical Education and Sports at Gazi University to investigate learners' perceptions of whether the classrooms at this school are ergonomically appropriate. 30.6% of the students were 21 or 22 years old; 43.2% of them were females, while 56.8% of them were male students. 31.2% of them spared 5 hours or more for studying. 79.2% of the seats were desks, and 43.2% of the lighting was artificial lighting. It was found that there was a significant difference between the genders in terms of regular cleaning of the classroom and the equipment used in it ($t= 2.00$, $p<0.05$); that is, the mean score of the female students (1.68) was higher than that of the male students (1.23). There was a significant difference between the genders for the item asking whether the learners think there is enough space for the legs between the chair and the desk ($t= -2.18$, $p<0.05$); that is, male students (1.46) had a higher mean score than the females (1.30). It was found that there was a significant difference between the genders in terms of the perceptions of giving regular breaks between the classes ($t= 2.14$, $p<0.05$); that is, the female students (1.58) had a higher mean score than the males (1.42). For university students to be successful in their educational life and to be safe from health problems, anthropometric measurements and learners' perceptions should be considered crucial. Designers and manufacturers should consider this and contribute to the formation of appropriate classrooms.

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1. Introduction

Ergonomics has lately received interest as a branch of science that studies the harmony between the environment and humans. Ergonomic design should be created by considering such issues as appropriate value, performance, human comfort, security and content (Dogru, 2009). The comfort of an individual in his/her immediate environment, his/her physical and mental health besides productivity depend on how compatible the equipment with the physical characteristics of the individual is. For the individual to be productive and healthy his/her needs should be met and appropriate conditions should be created in the atmosphere, where he/she lives and works. Ensuring these is the main purpose of the science of ergonomics (Gonen, 1988; Gonen and Kalinkara, 1991; Sabanci, 1999; Su, 2001). Ergonomics in education refers to the organization of instructional and learning environments in a such a way to maximize productivity. As it is the case in businesses, making use of the findings of this field of study boosts the quality and productivity of education (Zorlu and Erbay, 2011). Ergonomics in education aims to equip learners with real-life experience and behavioural

skills through sensory experiences. Since ergonomics studies the relations between the individual and workspace conditions at school and in the educational system, it mostly deals with the interaction between the child or adolescent and the environments that are reserved by the society for education (Dogru, 2009). Higher education is one of the most significant phases of a person's educational life. Therefore, it is crucial that the factors that have an impact on the learner's success should be known. There are environmental factors that affect the success of university students as there are quite a few individual ones. Physical environments/classrooms come foremost among the environmental factors (Ersoy et al., 2009).

The seating arrangement of the classroom is connected with the size of the place. Since locations have a direct impact on humans' success, they affect education either positively or negatively. It is, therefore, possible to lend support to the claim that small classrooms result in improved peer relations, motivation and rapport, while large ones lead to indifference, inadaptability and nervousness. Classrooms should be located at the south and south-east side of buildings. There must be 2 square meters

of space and 3 cubic meters of air for each student, and the length of the classrooms should be no more than 9 meters. The width of the classroom should be evaluated with respect to illumination. In general, a classroom's length can be 6 meters; in those classrooms with a length of over 7,5 meters, it is often difficult for the teachers to monitor students. The most appropriate height is 3-4 meters. The number of students in classrooms should not exceed 30 or 35 (Ekinici, 2007; Ekinici et al., 2009). The functionality and comfort of the chairs and desks used in classrooms and laboratories depend on their being appropriate for the users' physical characteristics (Jeong and Park, 1990; Ray et al., 1995). During the learning and teaching process, physical condition in the learning environment assume a significant role in helping learners acquire the course objectives. Therefore, the objectives of the program should be investigated well to plan the educational locations in line with these objectives. The classrooms in educational buildings should have various qualities so as to be appropriate for such activities as group work, presentations, exhibitions, sharing productions, establishing communication. In addition to the shape and material of the desks and chairs in the classroom, the appropriateness of the equipment for the anthropometric dimensions of the students' age range. Otherwise, various problems might emerge such as physical and health problems besides others related with concentration. In addition, productivity is reduced. Therefore, it is essential that educational buildings, particularly classrooms should be designed in such a way to meet the learners' physical and psycho-social needs and to be comfortable, healthy and secure (Zorlu and Erbay, 2011; Hira, 1980).

2. Method

This study was carried out to investigate learner perceptions of ergonomic appropriateness of the classrooms in vocational colleges of physical education and sports. The population of the study was composed of the learners studying at Gazi University School of Physical Education and Sports. 183 students studying at this school volunteered to take part in the study in 2012-2013 academic year. Survey method was used to collect the data. The survey form was designed using the related resources to make it comprehensible for the participants (Celik et al., 2006; Akalp and Yildirim, 2008; Ersoy, et al., 2009). It was composed of three sections: Demographic

information about the participants, evaluation of general information about the classrooms and environmental conditions, physical equipment and health and evaluation of ergonomic appropriateness of classrooms in the School of physical education and sports. The data were collected using survey methodology between 14th October, 2012 and 15th December, 2012. All the participants volunteered to take part in the study, and they sincerely responded to the items in the survey. The collected data were analysed using SPSS 15.0. Then, t test was carried out to investigate the impact of gender on the evaluation of ergonomic appropriateness of the classrooms in the school of physical education and sports. The statistical significance level was taken as 0.05 or 0.01.

3. Findings and Discussions

3.1. Demographic Data about the Learners

30.6% of the students included in the study sample were within the age range of 21-22 and 25.1% of them were 23-24 years old. 43.2% of the students were females, while 56.8% of them were males. 44.9% of the learners had 3 hours of classes or less; 23.9% of them had 4 hours of classes, and 31.2% of them had 5 hours of classes or more. 10.4% of the learners had health problems. The health problems in 36.8% of the students are related with the classroom. Those with a health problem stated that they had neck pain (28.6%), back pain (28.6%) or low back pain (28.6%) (Table 1).

3.2. General Information about the Classrooms

The mean size of the classrooms at the school included in the study is 70 square meters. The mean number of students that the classrooms house is 72. 79.2% of the participants stated that the seats in the classrooms were desks, 14.8% of them said that they were chairs with armrests. According to a great majority of the students (98.4%) the material used as the floor covering is granite marble. It is stated that 43.2% of the lighting type used in the classroom was artificial and 44.8% of it was natural + artificial. According to 91.3% of the students, the board used in the classroom was the whiteboard, and 41.0% of them stated that there was a sound system in the classroom. 86.3% of the students stated that projectors were used, and 7.1% of them stated that slide projectors were used as the equipment for visual instruction.

Table 1: Demographic Data about the Learners

Age	Frequency	%	Health Problems
≤ 20	55	30.1	Yes No
21 – 22	56	30.6	
23 – 24	46	25.1	
25 ≤	26	14.6	
Gender			Is the health problem related with the classroom?
Female	79	43.2	Yes
Male	104	56.8	No
Daily course duration (Hours)			Health problem related with the classroom
≤ 3 hours	62	44.9	Neck pain
4 hours	33	23.9	Back pain
≤ 5 hours	43	31.2	Low back pain
Total	138	100.0	TOTAL

Table 2: General information about the Classrooms

Seats	Frequency	%	Board Type	Frequency	%
Desk	145	79.2	Blackboard	4	2.2
Chair	11	6.0	Smart board	12	6.5
Chair with armrest	27	14.8	White board	167	91.3
Material used in floor covering			Sound system		
Mosaic	3	1.6	Yes	75	41.0
Granite marble	180	98.4	No	108	59.0
Type of Lighting			Visual instructional materials		
Natural lighting	22	12.0	Projector	158	86.3
Artificial lighting	79	43.2	Video player	2	1.1
Natural+Artificial lighting	82	44.8	Overhead projector	10	5.5
			Slide projector	13	7.1
Total	183	100.0	Total	183	100.0

3.3. The Evaluation of Ergonomic Conditions in Physical Education and Sports College Classrooms

3.3.1. The Evaluation of the Conditions in the Classroom Environment

When the impact of gender on the evaluation of environmental conditions is examined, it is seen that there was a significant difference between genders in terms of the perceptions of noise existence in the environment ($t = -2.30$, $p < 0.05$); that is, the male students (1.67) had a higher mean score than the females (1.50). There was also a significant difference between the genders in terms of regular cleaning of the classroom and the equipment used in it ($t = 2.00$, $p < 0.05$); that is, the female students (1.68) were affected more than the males (1.23). Being disturbed by bad smells (due to the restrooms, storerooms, cleaning materials, drainage) differs based on gender ($t = -4.16$, $p < 0.01$). In comparison with the female students (1.51), male students (1.79) were more seriously affected by bad smells in the

classroom (smells from the restrooms, storerooms, cleaning materials, the drainage system). For other items, there were no statistically significant differences between the female and male students (Table 3). For the item "Does the lighting illuminate the classroom enough?" Ersoy et al., (2009) found that the female students (1.28) had a higher mean score than the males (1.13) and that the difference between the groups was statistically significant. In addition, appropriate temperature of the classroom was statistically significant. Higher temperatures in classrooms lead to sluggishness, drowsiness and lack of concentration in students. It is essential that the room temperature should be adjusted well in line with environmental conditions. This is because very high or low temperatures negatively affect learners' concentration in the lesson. This in turn results in a decrease in learners' success. Therefore, the temperature of the schools particularly the classroom should be adjusted well.

Table 3 The impact of gender on evaluation of the conditions in the classroom

Evaluations of the Conditions in the Classroom Environment	Female $\bar{X} \pm SD$	Male $\bar{X} \pm SD$	t	p
Is the colour of the classroom wall appropriate?	1.35±0.48	1.25±0.44	1.38	0.168
Is the classroom illuminated adequately?	1.11±0.31	1.07±0.26	0.851	0.396
Is the temperature of the rooms moderate?	1.16±0.37	1.08±0.28	1.61	0.109
Is the floor covering of the classroom appropriate?	1.25±0.43	1.16±0.37	1.49	0.136
Is the classroom ventilated well?	1.62±0.48	1.51±0.50	1.36	0.174
Is the classroom noisy?	1.50±0.50	1.67±0.47	-2.30	0.022*
Do the walls and ceiling of the classroom have sound insulation?	1.92±1.10	1.73±0.44	1.61	0.107
Is the noise level in the classroom at a disturbing level?	1.70±0.45	1.78±0.41	-1.23	0.218
Does the lighting of the classroom make you feel comfortable?	1.27±0.45	1.19±0.39	1.37	0.172
Can you perceive the details of visual activities in the lessons?	1.26±0.44	1.18±0.38	1.34	0.180
Are there adjustable window shades?	1.59±0.49	1.64±0.48	-0.67	0.498
Are the light bulbs located appropriately?	1.15±0.36	1.19±0.39	-0.71	0.479
Is there defective (blinking, noisy) lighting equipment?	1.78±0.41	1.84±0.36	-1.06	0.288
Are problems related to defective lighting equipment solved quickly?	1.30±0.46	1.28±0.45	0.22	0.823
Are the classroom and the equipment in the classroom cleaned regularly?	1.68±2.25	1.23±0.42	2.00	0.047*
Are there old, dusty books and other materials in the classroom?	1.84±0.36	1.87±0.33	-0.52	0.602
Are there dangerous and visually disturbing materials, cables and other electricity equipment in the classroom?	1.65±0.47	1.71±0.45	-0.76	0.443
Have the precautions against strokes and injuries that are likely to happen due to the equipment been taken?	1.59±0.49	1.63±0.48	-0.54	0.587
Is there a disturbing smell (smells from the restrooms, storerooms, cleaning materials, drainage systems) in the classroom?	1.51±0.50	1.79±0.40	-4.16	0.000**

** $p < 0.01$ * $p < 0.05$ $Sd = 181$ $Female_N = 79$ $Male_N = 104$

3.3.2. Evaluation of the physical equipment

When the impact of gender on the evaluation of physical equipment is examined, it is seen that there was a significant difference between genders in terms of the learners' perceptions of the precautions about heating ($t = 2.13$, $p < 0.05$); that is, female students' mean score (1.15) was higher than those of the males (1.05). In terms of the seats' touching the floor in a balanced way, and ergonomically to allow the hips and knees to bend with the suitable angle, the male students' mean score (1.56) was higher than that of the females (1.40). This difference was statistically significant ($t = -2.19$, $p < 0.05$). There is also a significant difference between genders for the item asking whether the learners think there is enough space for the legs between the chair and the desk ($t = -2.18$, $p < 0.05$); that is, the male students (1.46) had a higher mean score than the females (1.30). It was

found that gender had no impact on other variables (Table 4).

In their study on furniture design in computer laboratories in furniture and decoration education, Efe et al., (2008) found that the type of chairs in computer laboratories were anthropometrically appropriate. Ersoy et al., (2009) found that the female students (1.47, 1.53 and 1.92) had a higher mean score than the males in terms of whether the capacity of the classrooms is adequate besides the proximity of the desks to the windows and adjustability of the chairs. They also found that more male students (1.33), in comparison with females (1.18) thought that the height of the desks was appropriate. Upon evaluating the measurements in the schools examined in their study, Zorlu and Erbay (2011) found that the areas allocated for classrooms in all schools were inadequate.

Table 4. The impact of gender on the evaluation of physical equipment

The evaluation of physical equipment	FemaleX ± SD	MaleX ± SD	t	p
Is the size of the classroom appropriate?	1.20±0.40	1.11±0.32	1.62	0.106
Is the capacity of the classroom enough?	1.25±0.43	1.23±1.02	0.18	0.856
Have the necessary precautions for heating been taken in the classroom?	1.15±0.36	1.05±0.23	2.13	0.034*
Are there enough windows in the classroom?	1.07±0.26	1.03±0.19	1.10	0.272
Are there enough seats in the classroom?	1.18±0.39	1.12±0.33	1.20	0.230
Are the seats in the classroom appropriate?	1.45±0.50	1.42±0.49	0.43	0.662
Is the height of the seats adjustable?	1.89±0.30	2.12±1.98	-1.00	0.317
Is the seat wide enough?	1.35±0.48	1.44±0.49	-1.19	0.233
Are the seats adjustable?	1.92±0.26	1.91±0.28	0.25	0.797
Do the seats have an armrest?	1.89±0.30	1.87±0.33	0.49	0.620
Have the seats been designed in a way to prevent falling off them?	1.65±0.47	1.73±0.44	-1.05	0.292
Have the seats been designed to enable the feet step on the floor appropriately and the hips and knees to bend with an appropriate angle?	1.40±0.49	1.56±0.49	-2.19	0.030*
Have the seats been designed to keep the hands and arms at the right angle (the distance between the armpits and wrists)?	1.50±0.50	1.77±2.06	-1.14	0.252
Are the edges of the seats curved?	1.44±0.49	1.48±0.50	-0.50	0.615
Is there enough space for the legs between the chairs?	1.30±0.46	1.46±0.50	-2.18	0.031*
Are there legrooms to be used whenever need arises?	1.29±0.45	1.39±0.49	-1.44	0.149
Is the floor appropriate for the seats to be moved freely?	1.50±0.50	1.50±0.50	-0.04	0.965
Is there enough space in the classroom for your personal belongings?	1.56±0.49	1.46±0.50	1.44	0.149
Is the board appropriate?	1.22±0.22	1.20±0.40	0.42	0.673
Are the visual educational materials in the classroom appropriate?	1.17±0.38	1.23±0.42	-0.88	0.379
Is the sound system in the classroom of appropriate quality?	1.54±0.50	1.53±0.50	0.07	0.938

* $p < 0.05$ $Sd = 181$ Female_N=79 Male_N=104

3.3.3. Evaluation of Health

When the impact of gender on giving regular breaks between the classes is examined, it is seen that the the female students (1.58) had a higher mean score than the males (1.42), and there was a significant difference between males and females ($t = 2.14$, $p < 0.05$). It was found that gender did not have an impact on other statements (Table 5).

For the items "Do you sweat while studying?" "Do you experience a tinnitus feeling in your ears while studying and after you have studied in the classroom?" "Do you feel blockage in your nasal area while studying and after you have studied in the classroom?" Ersoy et al., (2009) found that the female students (1.69, 1.85 and 1.86) had a higher mean score than the males (1.49, 1.66 and 1.68) and there was a significant difference between the scores of the male and female students. In a study in a higher education institution on computer laboratories' ergonomic appropriateness, Celik et al., (2006) found

that the laboratories were not designed ergonomically and led to health problems in students. In another study on university students, Akalp and Yildirim (2008) found that the height of the seats used in laboratories were not adjustable and the seats did not have back and arm support. They suggested that the chairs should be adjustable and should have back and arm support to make them ergonomically appropriate.

Anthropometric data in ergonomics are widely used in identifying workspaces, equipment and the physical measurements of furniture and clothes. The most significant unit in educational equipment is the studying unit that is composed of a desk and a seat. This is because students spend most of their time in the classroom sitting on their desks. The suitability of the equipment such as tables and chairs in classrooms for the learners is highly important in terms of both physical comfort and health (Zorlu and Erbay, 2011).

Table 5. The impact of gender on the evaluation of health

evaluation of health	FemaleX ± SD	MaleX ± SD	t	p
Do you take regular breaks in the classroom?	1.58±0.49	1.42±0.49	2.14	0.033*
Do you sweat while studying in the classroom?	1.74±0.43	1.71±0.45	0.52	0.598
Do you feel cold while studying in the classroom?	1.79±0.40	1.89±0.30	-1.83	0.068
Do you feel tired after studying in the classroom?	1.39±0.49	1.39±0.49	-0.02	0.980
Do you experience lack of concentration while studying and after you have studied in the classroom?	1.37±0.48	1.50±0.50	-1.75	0.081
Do feel a burning sensation and stinging pain in your eyes while studying and after you have studied in the classroom?	1.50±0.50	1.58±0.49	-1.07	0.282
Do you feel a low back pain while studying and after you have studied in the classroom?	1.31±0.46	1.35±0.48	-0.55	0.580
Do you feel a back pain while studying and after you have studied in the classroom?	1.32±0.47	1.38±0.48	-0.77	0.441
Do you feel a neck pain while studying and after you have studied in the classroom?	1.39±0.49	1.48±0.50	-1.19	0.236
Do you feel a shoulder pain while studying and after you have studied in the classroom?	1.54±0.50	1.62±0.48	-1.09	0.274
Do you feel an arm pain while studying and after you have studied in the classroom?	1.70±0.45	1.75±0.43	-0.62	0.536
Do you feel an upper arm pain while studying and after you have studied in the classroom?	1.65±0.47	1.75±0.43	-1.35	0.177
Do you feel a leg pain while studying and after you have studied in the classroom?	1.55±0.49	1.50±0.50	0.63	0.528
Do you feel a foot pain while studying and after you have studied in the classroom?	1.70±0.45	1.68±0.46	0.37	0.705
Do you feel a chest pain while studying and after you have studied in the classroom?	1.87±0.33	1.85±0.35	0.34	0.732
Do you feel an abdominal pain while studying and after you have studied in the classroom?	1.82±0.38	1.87±0.33	-0.98	0.327
Do you feel a headache while studying and after you have studied in the classroom?	1.49±0.50	1.60±0.49	-1.51	0.132
Do you experience a tinnitus feeling in your ears while studying and after you have studied in the classroom?	1.82±0.38	1.82±0.38	-0.07	0.942
Do you feel nervous while studying and after you have studied in the classroom?	1.67±0.47	1.70±0.45	-0.44	0.656
Do you feel blockage in your nasal area while studying and after you have studied in the classroom?	1.86±0.34	1.78±0.41	1.25	0.210

* $p < 0.05$ $Sd = 181$ $Female_N = 79$ $Male_N = 104$

4. Conclusions and Recommendations

According to the results of the present study that aims to evaluate the ergonomic properties the classrooms in the school of physical education and sports, majority of the students stated that the seats in the classrooms were desks with seats and the material used as the floor covering was granite marble. Classrooms are ventilated not only through the doors and windows naturally but also through artificial means. More than half of the students stated that the type of the board used in the classroom was a white board, and projectors were used as the visual education material. When the impact of gender on the evaluation of environmental conditions is examined,

it is seen that the male students were more strongly affected by the existence of such factors as noise, disturbing smell (smell from the restrooms, cleaning materials and drainage systems) than the female students were. It was also found that regular cleaning of the classroom and equipment affected the female students more than the males. When the impact of gender on the evaluation of physical equipment is examined, it is seen that there is a significant difference between the males and females in terms of the perceptions of whether necessary precautions regarding heating were taken or not. The female students were affected more than the males. In terms of the seats' touching the floor in a balanced way and

allowing the hips and knees to bend ergonomically with the suitable angle, there was a significant difference between the genders. When the impact of gender is examined in terms of the evaluation of health, giving regular breaks between the classes affected female students more than it did male students. In their educational lives, our children spend a great portion of the day sitting on desks. It is essential that students should be given the opportunity to be educated in classrooms with chairs and desks that are appropriate for their body's posture when doing such activities as reading, writing or listening in the classes. Therefore, the equipment in the classroom should be adequate and appropriate for the students' characteristics. In this way, thanks to appropriate designs, students do not experience health problems, and they will reach the desired attainment levels. In conclusion, when the ergonomic arrangements of the classes is considered, visual, audio, temperature, comfort, functionality, appropriate psychological and health conditions, equipment and space should be appropriate for the anthropometric characteristics of the students. Due to inappropriate anthropometric dimensions that change depending on such factors as genetic characteristics, age and gender, students not only experience some problems regarding learning levels and attainments but they also have some permanent health problems that emerge in the long run. For university students to be successful in their educational life and to be safe from health problems, such activities should be carried out immediately, and anthropometric measurements should be made and absolutely be used in designs. Designers and manufacturers should focus on such activities and the promotion of these activities. Ergonomic issues should also be considered in institutional imaging activities. Such studies should be given economic support.

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