

## Student Perceptions in the Evaluation of Ergonomic Convenience of the Classrooms at Akpinar Multi-Program High School

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**KEYWORDS** Classroom. Comfort. Ergonomic Human Engineering. Perception. Suitability. Student

**ABSTRACT** This study aims at evaluating ergonomic convenience of the classrooms at Akpinar Multi-Program High School, and it is conducted with 144 voluntary students out of which, 31.9% of the students were 15 years old, 30.6 percent were 16, and 54.2 percent were females, while 45.8 percent were males. The percentage of common high school students was 30.6 percent and the percentage of students with 7 hours of class a day was 81.9 percent. In addition, 74.3 percent of the classrooms had a capacity of 30. Also, 56.2 percent of the students stated that there was noise in the setting; 86.8 percent stated that ceilings and walls were not with sound insulation and 87.5 percent stated there were no adjustable shades available for the windows. It was observed that there was noise in the setting which varied significantly with (t=-2.79, p<0.01) and male students (1.56) were affected more than females (1.33) by the fact that there was noise in the setting. It is understood that sitting height is not adjustable (72.9%), that chairs are not adjustable (81.9%), that they have no arm rest (86.8%) and that material of desks is not designed in a way to avoid falling (76.4%). In the area of having enough legroom, male students (1.39) have a higher mean than females (1.20), and there is significant difference between male and females (t= -2.52, p<0.05). It is defined that students feel tired after study in the classroom (80.6%), and that there is distractibility during and after study in the classroom (68.8%). In the area of distractibility during and after study in the classroom, male students (1.50) have a higher mean than females (1.37), and in the case where there is distractibility during and after study in the classroom, it differs according to sex (t=-3.10, p<0.01).

### INTRODUCTION

Traditional efforts to deal with the enormous problem of workplace safety have proved insufficient, as they have tended to neglect the broader sociotechnical environment that surrounds workers. Here, the researchers advocate a sociotechnical systems approach that describes the complex multi-level system factors that contribute to workplace safety. From the literature on sociotechnical systems, complex systems and safety, the researchers develop a sociotechnical model of workplace safety with concentric layers of the work system, socio-organisational context and the external environment. The future challenges that are identified through the model are highlighted. Understanding the environmental, organisational and work system factors that contribute to workplace safety will help to develop more effective and integrated solutions to deal with persistent workplace safety

problems. Solutions to improve workplace safety need to recognise the broad sociotechnical system and the respective interactions between the system elements and levels (Carayon et al. 2015).

The secondary education has an important role in the training of mature and skilled citizen that every society needs. Therefore, underdeveloped countries take a great risk when they ignore the secondary education. In such countries, governments generally give priority to primary and higher education at the detriment of the secondary education, resulting in a bottleneck situation which almost all the underdeveloped countries are struggling with and this has generated the most important obstacles for improving human resource in terms of social and economical development (Harbison 1962).

Basically, in economy and industry, ergonomics, which is the study of the relationships between mankind and work and mankind and his

environment, has started to become popular in every field of life in terms of the harmony between machines and human (Öncül 2000). The main objective of ergonomics is to increase the quality of life (Simsek and Nursoy 2004). In education however, it means, organizing the work and study settings of teachers and students in order to reach maximum output. As it is with firms, when education benefits from this field of science, it will lead to an increase in quality and in productivity as well.

Therefore, it needs to be determined whether it is the current state, or the development in the future that should be taken into consideration when planning classrooms. The number of students in each classroom and the weekly course hour will definitely affect the planning to be made. The control of the heat, light and sound should be planned in accordance with the classroom size. When placing the tool, electrical wiring and sockets should be taken into consideration, blackboards, bulletin boards and specific individual study corners should be made adequate, and exhibition areas and teachers' desks should be near to implementation place. Necessary precautions should be taken against fire. Door openings and locks should be made in a certain order (Dogan 1983). The plan to be made should be of a quality that easily agrees with the current education idea. Classroom organization should be designed with reference to current and vocational educational concepts. In modern planning, basic matters such as job safety, material and staff flow should be paid attention. The plan should encourage both teachers and students in the implementation of the objectives of the establishment (Sezgin and Alkan 1971).

There should be a part in the spaces between two classrooms which should include coat hangers or lockers, where students can place their belongings such as raincoat or coat, and the width of it should be a minimum of 2.20 cm; hangers should have a maximum of 1.60 cm ground clearance and 0.20 cm gap in between; there should be a means of water disposal for the rain water that will gather because of the raincoats or coats, else, hangers should be placed in niches in the hallways (TSE 1991). Classroom doors should have a minimum of 90 cm width. If classroom doors are 140 cm or more in width, doors should have two wings. Classroom doors should open to hallways. In hallways where classroom are placed on both sides, doors should not open as

opposing. Classroom doors should be placed between the first desk and the blackboard (MEB 1995).

The main aim of classroom lighting is to provide good sight setting as educational objective requires. Even though it looks easy to prepare such a setting, lighting issue has been widely argued about for years with issues such as, deciding how much to benefit from day light if there is any, type of lighting, designing electrical lighting, the specifics of shiny samples; level of lighting, brightness and luminance taking the front burner. Besides, it is of great importance to bring optical environment in compliance with learning (Boyd 1978).

It is very important to radiate and generate heat in places such as classroom and laboratory in schools. Moreover, how to generate the appropriate heat which will be suitable for the teaching environment must be taken into consideration (Rutger 1978).

Noise slowly consumes human energy and performance. Noise is a factor which is capable of preventing both the teacher and the student from being successful. This is because noise distracts attention, reduces focus and hinders one from concentrating on the matter at hand. As a result of comparing the works in loud settings to quiet settings, it has been experimentally indicated that there is 19 percent increase in the energy spent. High volume sound or noise slows down mental operations, shadows the ability of reasoning, and lowers the success of students and teachers (Gilliland 1978). If these features are taken into proper consideration in organizing a convenient classroom order, then, students' performance might increase.

## METHODOLOGY

This study aims at analyzing students' opinion regarding the evaluation of ergonomic convenience of class rooms at Akpınar Multi-Program High School. The research population is comprised of students at Akpınar Multi-Program High School. Akpınar Multi-Program High School has 10 classrooms, 1 science lab and 1 computer classroom. There is full-time schooling at the school. Classes start at 08:30 am, and end at 15:25pm. Total number of students is 200. 144 students who were studying during 2013-2014 educational year at Akpınar Multi-Program High School volunteered for the study. Questionnaire

technique was used for indicating the opinion of students in evaluating the ergonomic convenience of the classrooms. The questionnaire form consisted of three parts which were: (1) demographic features of students, evaluation regarding general classroom guidelines and classroom setting conditions, (2) evaluation regarding physical equipments, and (3) evaluation regarding health (Table 1).

The research data was gathered through questionnaire technique between 03/03/2014 and 30/04/2014. All the participating students volunteered willingly in the study and answered the questions genuinely. SPSS 16.0 program was used to analyze the data gathered. The questionnaire form was evaluated and tables indicating number and percentage values of the demographic features of the students and general information of classrooms were formed. Then, tables showing number and percentage values in evaluating the ergonomic convenience of the classrooms at Akpınar Multi-Program High School were formed. The effect of sex was investigated through t-test. The significant difference among variables was commented on, to be at 0.05 or 0.001 level.

## RESULTS

Student participants who were 15 years old were 31.9 percent, 30.6 percent were 16 and 37.5 percent were 17. 54.2 percent of the students were females and 45.8 percent were males. While common high school students were 30.6 percent, and vocational high school students constituted 69.4 percent of the sample population. Students with 6 classes a day were 18.1 percent of

the sample population, while the ones with 7 classes a day constituted a total of 81.9 percent. The answers which showed the average hours of classroom use also showed the same ratio. 11.1 percent of the students have health related problems, and it was identified that the health related problems of the students (n=16) are not related to classroom.

A total number of 25.7 percent of the participating students stated the capacity of the classroom as 25 people and 74.3 percent stated as 30 (Table 2). Classroom size according to user population was 15-25 for 62 participants, 25-30 for 27 participants and 30-35 for 55 participants. Participants stated that the sitting material was desks and floor covering was granite marble. They stated that both natural and artificial lighting were present in the classroom and the light type available was white light. They also stated that the board used in the classroom was whiteboard, and any visual material and sound system were not available in the classroom. Students stated the color of the classroom as white (25.7%), blue

**Table 2: General information about classrooms**

<i>Capacity of the classroom</i>	<i>Number</i>	<i>%</i>
Capacity	25 people	25.7
	30 people	74.3
<i>Color of the Classroom</i>		
White	37	25.7
Blue	35	24.3
Red	22	15.3
Purple	22	15.3
Green	16	11.1
Orange	7	4.9
Yellow	5	3.5
Total	144	100.0

**Table 1: Demographic features of students**

<i>Age</i>	<i>Number</i>	<i>%</i>	<i>Daily classes (hours)</i>	<i>Number</i>	<i>%</i>
15	46	31.9	6	26	18.1
16	44	30.6			
17	54	37.5	7	118	81.9
<i>Sex</i>			<i>Health problem</i>		
Female	78	54.2	Yes	16	11.1
Male	66	45.8	No	128	88.9
Total	144	100.0	Total	144	100.0
<i>High school type</i>			<i>Relation of health problem to classroom</i>		
Common High School	44	30.6	Yes	-16	-
Vocational High School	100	69.4	No	-	100.0
Total	144	100.0	Total	16	100.0

(24.3%), red (15.3%), purple (15.3%), green (11.1%), orange (4.9%) and yellow (3.5%).

When the evaluation regarding classroom settings was analyzed according to the students in the research scope (Table 3), it was discovered that the color of the walls are not suitable (54.9%), there is enough lighting in the classroom (83.3%), the temperature is suitable (85.4%), the floor coverings in the classroom is suitable (70.8%). It is however defined that air flow in the classroom is not suitable (33.3%), that there is noise in the setting (56.2%) and that the ceiling and walls are not covered with sound insulation material. It is determined that the noise volume is at a disturbing rate of (46.5%), that the students do not feel comfortable with the available lighting (22.2%), that they cannot understand the details of the visual activities during the course (36.1%), that there are no adjustable shades on the windows (88.2%), that the places of electric powers are planned (87.5%), that there is no defective (flashing, noisy) lighting equipment (84.7%), and that the classroom and all the equipments are cleaned regularly (36.8%). It is also determined that there are no unnecessary materials such old, dusty books in the classroom (81.2%), that there are dangerous and unsightly cables and electrical equipments in the classroom (25.7%), that the necessary precautions against dangers such as strikes and wounds due to equipments and materials are not taken (45.1%) and that there is a disturbing smell due to the classroom surroundings (restroom, storehouse etc.) (29.9%).

When the sex effect regarding classroom setting conditions was analyzed, it was discovered that there is noise in the classroom which significantly changes according to sex ( $t = -2.79$ ,  $p < 0.01$ ), and that the male students (1.56) are affected by the noise more than females (1.33). No significant difference was determined in other statements.

When the evaluation regarding physical equipment was analyzed, it was determined that according to the students in the research scope, the size of the classroom is suitable (86.1%), that classroom is large enough in capacity (79.9%), that precautions regarding class temperature are taken (85.4%), that the number of the windows in the classroom is enough (93.8%) and that the number of desks/chairs is enough (88.2%). It was however determined that materials for desks are not suitable (30.6%), that sitting height is not adjustable (72.9%), the width of desks/chairs is

not appropriate (30.6%), that desks/chairs are not adjustable (81.9%), that desks/chairs have no arm rest (86.8%), that desks and chairs are not designed to avoid falling (76.4%), that materials for desks and chairs are not designed in a manner which allows the feet step on the floor with a flat angle and letting hips and knees bend with a proper angle (44.4%), that desks/chairs are not designed in a manner which allows the arms and hands to be in a proper angle (53.5%), that the corners of desks and chairs are not rounded (68.8%) and that there is not enough space for knee and leg space available (29.2%).

Students stated that there is place to put feet when needed (74.3%), that the floor covering allows the desks/chairs materials to be easily moved (73.6%), that there is not enough space to store personal belongings (63.9%), that the board used is suitable (78.5%), that visual material used on the classroom is not suitable (63.2%) and that the sound system used in the classroom is not suitable (81.2%).

When the sex effect in evaluation regarding physical equipment was analyzed, it was discovered that taking precautions for classroom temperature differs according to sex ( $t = -2.09$ ,  $p < 0.05$ ), and male students (1.21) are affected by the precautions for classroom temperature more than female students (1.08).

In having enough knee and leg room space, male students have a higher average point of (1.39) than the females' (1.20), and having enough knee and leg space is affected by sex ( $t = -2.52$ ,  $p < 0.05$ ). In the other statements, no sex effect was determined (Table 6).

When evaluation regarding health was analyzed, it was discovered that there are regular recess in the classroom (69.4%), students sweat during study in the classroom (29.2%), they feel cold during study (23.6%), they feel tired after they have studied (80.6%), they suffer from distractibility during and after study in the classroom (68.8%), they suffer from burning/stinging eyes during and after study in the classroom (43.1%), they suffer from low back pain during and after study (53.5%), they suffer from back ache during and after study in the classroom (48.6%), they suffer from neck pain during and after study in the classroom (53.5%), they suffer from shoulder pain during and after study in the classroom (38.2%), they suffer from forearm pain during and after study in the classroom (38.2%), they suffer from leg ache during and after study

**Table 3: Evaluation regarding classroom setting conditions (n=144)**

Evaluation regarding classroom setting conditions	Yes		No	
	N	%	N	%
Is the color of classroom walls suitable?	65	45.1	79	54.9
Is the classroom lighting adequate?	120	83.3	24	16.7
Is the classroom temperature suitable?	123	85.4	21	14.6
Is the classroom floor covering suitable?	102	70.8	42	29.2
Is the classroom ventilation suitable?	96	66.7	48	33.3
Is there noise in the setting?	81	56.2	63	43.8
Are ceiling and walls covered with noise insulation material?	19	13.3	125	86.8
Is the level of noise high and disturbing?	67	46.5	77	53.5
Do you feel relaxed with the lighting available?	112	77.8	32	22.2
Do you perceive the details of the visual activities during the course?	92	63.9	52	36.1
Are there adjustable shades on the windows?	17	11.8	127	88.2
Are the places of lamps/bulbs planned?	126	87.5	18	12.5
Is there any defective (blinking, noisy) lighting equipment?	22	15.3	122	84.7
Do the problems of defective equipment get fixed in a short time?	90	62.5	54	37.5
Do the classroom and all equipments get cleaned regularly?	91	63.2	53	36.8
Are there any unnecessary materials such as old, dusty books in the classroom?	27	18.8	117	81.2
Are there any dangerous and unsightly cables and electrical equipments in the classroom?	37	25.7	107	74.3
Are the necessary precautions taken against dangers such as strikes and wounds due to faulty equipments and materials?	79	54.9	65	45.1
Is there any disturbing smell due to the classroom surroundings (restroom, storehouse)?	43	29.9	101	70.1

**Table 4: Sex effect regarding evaluation of classroom setting conditions**

Evaluation of classroom setting conditions	Female	Male	T	p
	X ± SD	X ± SD		
Is the color of classroom walls suitable?	1.53±0.50	1.56±0.50	-0.264	0.792
Is the classroom lighting adequate?	1.11±0.32	1.22±0.42	-1.803	0.074
Is the classroom temperature suitable?	1.11±0.32	1.18±0.38	-1.123	0.264
Is the classroom floor covering suitable?	1.26±0.44	1.31±0.46	-0.640	0.523
Is the classroom ventilation suitable?	1.30±0.46	1.36±0.48	-0.706	0.481
Is there noise in the setting?	1.33±0.47	1.56±0.50	-2.794	0.006**
Are the ceilings and walls covered with noise insulation material?	1.89±0.30	1.83±0.37	1.130	0.261
Is the level of noise high and disturbing?	1.46±0.50	1.62±0.48	-1.925	0.056
Do you feel relaxed with the lighting available?	1.17±0.38	1.27±0.44	-1.340	0.182
Do you perceive the details of the visual activities during the course?	1.38±0.48	1.33±0.47	0.635	0.527
Are there adjustable shades on the windows?	1.89±0.30	1.86±0.34	0.623	0.534
Are the places of lamps/bulbs planned?	1.12±0.33	1.12±0.32	0.126	0.900
Is there any defective (blinking, noisy) lighting equipment?	1.84±0.36	1.84±0.36	-0.038	0.969
Do the problems of defective equipments get fixed in a short time?	1.32±0.46	1.43±0.50	-1.469	0.144
Do the classroom and all equipments get cleaned regularly?	1.35±0.48	1.37±0.48	-0.244	0.808
Are there any unnecessary materials such as old, dusty books in the classroom?	1.85±0.35	1.75±0.43	1.556	0.122
Are there any dangerous and unsightly cables and electrical equipment in the classroom?	1.75±0.43	1.72±0.44	0.396	0.493
Are the necessary precautions taken against dangers such as strikes and wounds due to faulty equipments and materials?	1.50±0.50	1.39±0.49	1.273	0.205
Is there any disturbing smell due to the classroom surroundings (restroom, storehouse)?	1.76±0.42	1.62±0.48	1.946	0.054

\*\*p&lt;0.01

Female <sub>n</sub>=78 Male <sub>n</sub>=66

**Table 5: Evaluation regarding physical equipments (n=144)**

Evaluation regarding physical equipments	Yes		No	
	N	%	N	%
Is the classroom size suitable?	124	86.1	20	13.9
Is the classroom enough as capacity?	115	79.9	29	20.1
Are the necessary precautions regarding temperature in the classroom taken?	123	85.4	21	14.6
Is the number of windows enough?	135	93.8	9	6.2
Is the number of desks/chairs enough?	127	88.2	17	11.8
Is the material for desks/chairs suitable?	100	69.4	44	30.6
Is the sitting height adjustable?	39	27.1	105	72.9
Is the width of the desk/chair enough?	100	69.4	44	30.6
Is the desk/chair you use adjustable?	26	18.1	118	81.9
Does the desk/chair you use have an armrest?	19	13.2	125	86.8
Is the material for desks/chairs designed to avoid falling?	34	23.6	110	76.4
Is the material for desk/chair designed in a manner which allows the feet to step on the floor with a flat angle, and allows the hips and knees to bend at a proper angle?	80	55.6	64	44.4
Are the desks/chairs designed in a manner which allows the arms and hands to be in a proper angle?	67	46.5	77	53.5
Are the corners of the desks/chairs straight and cornered?	45	31.2	99	68.8
Is there enough available space for knee and leg?	102	70.8	42	29.2
Is there a place to put feet when needed?	107	74.3	37	25.7
Does the floor covering allow the desks/chairs materials move easily?	106	73.6	38	26.4
Is there enough place to store your personal belonging?	52	36.1	92	63.9
Is the board used suitable?	113	78.5	31	21.5
Is the visual material used in the classroom suitable?	53	36.8	91	63.2
Is the sound system used in the classroom suitable?	27	18.8	117	81.2

**Table 6: Sex effect in evaluation regarding physical equipments**

Evaluation regarding physical equipments	Female	Male	T	p
	X ± SD	X ± SD		
Is the classroom size suitable?	1.14±0.35	1.13±0.34	0.080	0.936
Is the classroom enough in capacity?	1.20±0.40	1.19±0.40	0.121	0.904
Are the necessary precautions regarding temperature in the classroom taken?	1.08±0.28	1.21±0.41	-2.090	0.038*
Is the number of windows enough?	1.05±0.22	1.07±0.26	-0.601	0.549
Is the number of desks/chairs enough?	1.08±0.28	1.15±0.36	-1.142	0.255
Is the material for desks/chairs suitable?	1.29±0.45	1.36±0.49	-0.301	0.764
Is the sitting height adjustable?	1.78±0.41	1.66±0.47	1.555	0.122
Is the width of the desk/chair enough?	1.26±0.44	1.34±0.48	-1.025	0.307
Is the desk/chair you use adjustable?	1.82±0.38	1.81±0.38	0.036	0.971
Does the desk/chair you use have an armrest?	1.87±0.33	1.84±0.33	0.143	0.886
Is the material for desks/chairs designed to avoid falling?	1.75±0.43	1.77±0.42	-0.228	0.820
Is the material for desk/chair designed in a manner which allows the feet to step on the floor with a flat angle, and also allow the hips and knees to bend at a proper angle?	1.46±0.50	1.42±0.49	0.446	0.656
Is the desk/chair designed in a manner which allows the arms and hands to be in a proper angle?	1.52±0.50	1.54±0.50	-0.236	0.814
Are the corners of desks/chairs straight and cornered?	1.70±0.45	1.66±0.47	0.493	0.623
Is there enough available space for knee and leg?	1.20±0.40	1.39±0.49	-2.521	0.013*
Is there a place to put feet when needed?	1.19±0.39	1.33±0.47	-1.942	0.054
Does the floor covering allow the desks/chairs materials to move easily?	1.25±0.43	1.27±0.44	-0.220	0.826
Is there enough place to store your personal belonging?	1.66±0.47	1.60±0.49	0.751	0.454
Is the board used suitable?	1.21±0.41	1.21±0.41	0.084	0.933
Is the visual material used in the classroom suitable?	1.65±0.47	1.60±0.49	0.589	0.557
Is the sound system used in the classroom suitable?	1.80±0.39	1.81±0.38	-0.160	0.873

\*p&lt;0.05 Kiz N=78 Erkek N=66

**Table 7: Evaluation regarding health (n=144)**

Evaluation regarding health	Yes		No	
	N	%	N	%
Do you have regular recess times in the classroom?	100	69.4	44	30.6
Do you sweat during study in the classroom?	42	29.2	102	70.8
Do you feel cold during study in the classroom?	34	23.6	110	76.4
Do you feel tired after study in the classroom?	116	80.6	28	19.4
Do you suffer from distractibility during and after study in the classroom?	99	68.8	45	31.2
Do you suffer from burning/stinging eyes during and after study in the classroom?	62	43.1	82	56.9
Do you suffer from low back pain during and after study in the classroom?	77	53.5	67	46.5
Do you suffer from back pain during and after study in the classroom?	70	48.6	74	51.4
Do you suffer from neck pain during and after study in the classroom?	77	53.5	67	46.5
Do you suffer from shoulder pain during and after study in the classroom?	55	38.2	89	61.8
Do you suffer from forearm pain during and after study in the classroom?	55	38.2	89	61.8
Do you suffer from upper arm pain during and after study in the classroom?	36	25	108	75
Do you suffer from leg pain during and after study in the classroom?	35	24.3	109	75.7
Do you suffer from foot pain during and after study in the classroom?	29	20.1	115	79.9
Do you suffer from chest pain during and after study in the classroom?	25	17.4	119	82.6
Do you suffer from stomachache during and after study in the classroom?	21	14.6	123	85.4
Do you suffer from headache during and after study in the classroom?	98	68.1	31.9	31.9
Do you suffer from tinnitus during and after study in the classroom?	42	29.2	102	70.8
Are you angry during and after study in the classroom?	59	41	85	59
Do you suffer from blocked nose during and after study in the classroom?	24	16.7	120	83.3

in the classroom (25%), and they suffer from foot pain during and after study in the classroom (20.1%).

Students stated that they do not suffer from chest pain during and after study in the classroom (82.6%), they do not suffer or have stomachache during and after study in the classroom (85.4%), they suffer from headache during and after study in the classroom (68.1%), they do not suffer from tinnitus (70.8%), they are not angry during and after study in the classroom (59%), and they do not suffer from blocked nose during and after study in the classroom (83.3%).

When sex effect in evaluation regarding health was analyzed, it was discovered that the male students with a ratio of (1.50) had a higher average point than females' (1.37), in suffering from distractibility during and after study and that the distractibility during and after study in the classroom is affected by the sex of the student ( $t = -3.10, p < 0.01$ ).

Female students have a higher average point (1.79) than male students in suffering from foot pain during and after study, and that there is foot pain during and after study in the classroom which significantly changes according to the sex of the student ( $t = 1.97, p < 0.05$ ).

## DISCUSSION

When the evaluation regarding classroom settings was analyzed according to the number

of students in the research scope, it was discovered that the color of the walls are not suitable (54.9%), there is enough lighting in the classroom (83.3%), the temperature is suitable (85.4%), the floor coverings in the classroom is suitable (70.8%). It was however defined that air flow in the classroom is not suitable (33.3%), that there is noise in the setting (56.2%) and that the ceiling and walls are not covered with sound insulation material. It was also discovered that the noise volume is at a disturbing rate (46.5%), that the students do not feel comfortable with the available lighting (22.2%), that they cannot understand the details of the visual activities during the course (36.1%), that there are no adjustable shades on the windows (88.2%), that the places of electric powers are planned (87.5%), that there is no defective (flashing, noisy) lighting equipment (84.7%), and that the classrooms and all the equipment are regularly cleaned up (36.8%). That there are no unnecessary materials such as old, dusty books in the classroom (81.2%), that there are dangerous and unsightly cables and electrical equipment in the classroom (25.7%), that the necessary precaution taken against dangers such as strikes and wounds due to failure of equipment and sub-standard materials are not taken (45.1%), and that there is disturbing smell from the surrounding of the classrooms (re-stroom, storehouse etc.) (29.9%).

When the sex effect regarding classroom setting conditions was analyzed (Table 4), it was

**Table 8: Sex effect in evaluation regarding health**

<i>Evaluation regarding health</i>	<i>Female X ± SD</i>	<i>Male X ± SD</i>	<i>T</i>	<i>p</i>
Do you have regular recess times in the classroom?	1.26±0.44	1.34±0.48	-1.025	0.307
Do you sweat during study in the classroom?	1.75±0.43	1.65±0.48	1.379	0.170
Do you feel cold during study in the classroom?	1.75±0.43	1.77±0.42	-0.228	0.820
Do you feel tired after study in the classroom?	1.14±0.35	1.25±0.44	-1.768	0.079
Do you suffer from distractibility during and after study in the classroom?	1.37±0.48	1.50±0.50	-3.101	0.002**
Do you suffer from burning/stinging eyes during and after study in the classroom?	1.20±0.40	1.43±0.50	-0.476	0.635
Do you suffer from low back pain during and after study in the classroom?	1.55±0.50	1.59±0.49	0.904	0.367
Do you suffer from back pain during and after study in the classroom?	1.50±0.50	1.42±0.49	0.972	0.332
Do you suffer from neck pain during and after study in the classroom?	1.55±0.50	1.406±0.50	-0.765	0.446
Do you suffer from shoulder pain during and after study in the classroom?	1.43±0.49	1+0.50±0.50	1.304	0.194
Do you suffer from forearm pain during and after study in the classroom?	1.66±0.47	1.56±0.50	1.304	0.194
Do you suffer from upper arm pain during and after study in the classroom?	1.66±0.47	1.56±0.50	0.576	0.566
Do you suffer from leg pain during and after study in the classroom?	1.76±0.42	1.72±0.44	1.151	0.252
Do you suffer from foot pain during and after study in the classroom?	1.79±0.40	1.71±0.45	1.977	0.050*
Do you suffer from chest pain during and after study in the classroom?	1.85±0.35	1.72±0.44	1.576	0.120
Do you suffer from stomachache pain during and after study in the classroom?	1.87±0.33	1.77±0.42	0.648	0.518
Do you suffer from headache during and after study in the classroom?	1.25±0.43	1.39±0.49	-1.771	0.079
Do you suffer from tinnitus during and after study in the classroom?	1.75±0.43	1.65±0.48	1.379	0.170
Are you angry during and after study in the classroom?	1.57±0.49	1.60±0.49	-0.352	0.725
Do you suffer from blocked nose during and after study in the classroom?	1.87±0.33	1.78±0.41	1.345	0.181

\*p<0.05 Female <sub>N</sub>=78 Male <sub>N</sub>=66

discovered that there is noise in the classroom, which significantly changed according to sex ( $t = -2.79$ ,  $p < 0.01$ ) and that the male students (1.56) are affected by the noise more than females (1.33). No significant difference was defined in other statements. Efe et al. (2008), emphasized that the environments and settings, where ergonomically designed places, equipment and tools are available, and that they contribute positively to the physical and spiritual development of the students and will be effective in helping students acquire more knowledge and skills in short time by motivating them. Arpacı et al. (2013) proved that there was noise in the setting changes according to sex ( $t = -2.30$ ,  $p < 0.05$ ), and that the male students (1.67) are affected by the noise more than females (1.50).

When evaluation regarding physical equipment was analyzed (Table 5), it was discovered that according to the students in the research scope, that the size of the classroom is suitable (86.1%), that classroom is large enough in capacity (79.9%), that precautions regarding class temperature are taken (85.4%), that the number of the windows in the classroom is enough (93.8%) and that the number of desks/chairs is enough (88.2%). It was however determined that materials for desks are not suitable (30.6%), that sitting height is not adjustable (72.9%), the width of desks/chairs is not enough (30.6%), that desks/chairs are not adjustable (81.9%), that desks/chairs have no arm rest (86.8%), that desks and chairs are not designed to avoid falling (76.4%), that materials for desks and chairs are not designed in a manner which allows the feet



to step on the floor with a flat angle and allows the hips and knees to bend at a proper angle (44.4%), that desks/chairs are not designed in a manner which allows the arms and hands to be placed in a proper angle (53.5%), that the corners of desks and chairs are not rounded (68.8%), and that there is no enough available space for knee and leg space (29.2%).

Students stated that there is place to put feet when needed (74.3%), that the floor covering allows the desks/chairs materials to move easily (73.6%), that there is not enough space to store personal belongings (63.9%), that the board used is suitable (78.5%), that visual material used on the classroom is not suitable (63.2%) and that the sound system used in the classroom is not suitable (81.2%).

When the sex effect in evaluation regarding physical equipment was analyzed, it was discovered that taking precautions for classroom temperature differs according to sex ( $t = -2.09$ ,  $p < 0.05$ ) and male students (1.21) are affected by the precautions for classroom temperature more than female students (1.08).

In having enough knee and leg room space, male students have a higher average point (1.39) than the females (1.20), and having enough knee and leg space is affected by sex ( $t = -2.52$ ,  $p < 0.05$ ). In the other statements, no sex effect was determined.

Aksoy and Kelesoglu (2004) emphasized that the ergonomic features of physical equipment are quite important matters in terms of harmony between students, and the equipment in a course setting with learning objectives.

Ersoy et al. (2009) found that female students have a higher average point than male students in statements that study rooms are of suitable capacity, desks are close to windows and chair are adjustable (1.47, 1.53 and 1.92) and the difference between the groups is statistically significant.

Also, they stated that male students (1.33) find the height of the desk more suitable than females (1.18). Zorlu and Erbay found the classroom size in all the schools inadequate when they evaluated the determination and measurements done in the classrooms of the school involved in the study. Arpaci et al. (2013) found that taking precautions for the classroom temperature changes according to sex, and female students (1.15) are affected by the precautions for the classroom temperature more than male students (1.05).

When evaluation regarding health (Table 7) was analyzed, it is found that there are regular recess in the classroom (69.4%), students sweat during study in the classroom (29.2%), they feel cold during study (23.6%), they feel tired after they have studied (80.6%), they suffer from distractibility during and after study in the classroom (68.8%), they suffer from burning/stinging eyes during and after study in the classroom (43.1%), they suffer from low back pain during and after study (53.5%), that they suffer from back ache during and after study in the classroom (48.6%), they suffer from neck pain during and after study in the classroom (53.5%), they suffer from shoulder pain during and after study in the classroom (38.2%), they suffer from forearm pain during and after study in the classroom (38.2%), they suffer from leg ache during and after study in the classroom (25%), and they suffer from foot pain during and after study in the classroom (20.1%).

Students stated that they do not suffer from chest pain during and after study in the classroom (82.6%), they do not suffer or have stomachache during and after study in the classroom (85.4%), they suffer from headache during and after study in the classroom (68.1%), they do not suffer from tinnitus (70.8%), they are not angry during and after study in the classroom (59%), and they do not suffer from blocked nose during and after study in the classroom (83.3%).

When sex effect in evaluation regarding health was analyzed (Table 8), male students (1.50) had a higher average point than females (1.37) in suffering from distractibility during and after study and there was distractibility during and after study in the classroom, which was affected by the sex of the student. ( $t = -3.10$ ,  $p < 0.01$ ). Female students proved to have a higher average point (1.79) than male students in suffering from foot pain during and after study, and also during and after study in the classroom which can significantly change according to the sex of the student. ( $t = 1.97$ ,  $p < 0.05$ ).

No sex effect was determined in the other statements. In a study with university students on the ergonomic convenience of computer labs, Çelik et al. (2006), found that the laboratory is not designed in a suitable way for the students as a classroom setting and that it causes various health problems for students.

According to Oyewole et al. (2015) children have been known to spend over 30 percent of

their time at school. Most classroom activities involve sitting for long periods of time, with little or no breaks. Every effort should be made to ensure that young children do not experience back pain and other musculoskeletal disorders due to prolonged sitting on improperly designed classroom furniture. This paper proposes a methodology and guidelines for the design of ergonomic-oriented classroom furniture for first graders in the elementary school. The anthropometric measures of twenty first graders were used to develop regression equations for the furniture dimensions. The analysis of the relevant anthropometric measures such as stature, weight, body mass index (BMI), popliteal height, buttock-popliteal length, and hip breadth shows that stature and body mass index are important factors in the design of the classroom furniture. Adjustability was incorporated into the design in order to recommend the appropriate dimensions for the design of the classroom furniture. Based on the need to accommodate at least 90 percent of the population of first graders in the United States, this paper proposes furniture design dimensions for seat height (25.83–32.23 cm); seat depth (27.41–33.86 cm); seat width (17.91–23.29 cm); back rest (35.64–44.37 cm); arm rest (16.28–20.68 cm); and desk height (30.12–37.85 cm). This anthropometric analysis could be used to design ergonomic-oriented classroom furniture which would not only incorporate adjustability, but also improve the level of comfort for the intended users.

### CONCLUSION

According to the results gained from this study which was designed to investigate students' perceptions of evaluation of the ergonomic convenience of the classrooms at Akpınar Multi-Program High school, more than half of the students stated that the classroom capacity is 30. They stated that there are both natural and artificial lighting in the classroom and the light type of the classroom is white light. They stated that the board used in classroom is white board and that there is no visual educational material and no sound system is available in the classroom. The color of the classroom is mostly white or blue.

When the evaluation regarding classroom setting was analyzed, it was discovered that the air flow in the classroom is not suitable, there is noise in the setting, and ceiling and walls of the classroom are not covered with sound insula-

tion material. Some students stated that they could not understand the details of the visual activities of the course, that there are no adjustable shades for the windows and that there are not precautions taken against the dangers such as strike; bruise etc. due to faulty equipment and tools in the classroom.

It is understood that there is noise in the setting which can significantly change according to sex, and that the male students are affected by the fact that there is noise in the setting more than the female students.

When evaluation regarding physical equipment was analyzed, it was discovered that for most of the students, the width of desks/chairs are not enough, the desks/chairs are not adjustable, the chairs have no arm rest, material for desks/chairs is not designed to avoid falling, and the desks/chairs are not designed to let hands and arms be in the proper angle and their corners are not straight and rounded. It is seen that taking precautions for classroom temperature changes according to sex, and male students are affected by the case of taking precautions for classroom temperature more than female students. It was also found that the case which bordered on whether there is enough space for knee and leg room or not, changes according to sex.

When evaluation regarding health was analyzed, it was discovered that some students sweat during study, some feel cold, some feel tired after study in the classroom and feel distracted. Some of the students suffer from back pain, neck pain, shoulder pain, forearm pain, upper arm pain, leg pain and foot pain during and after study in the classroom. That there is distractibility during and after study in the classroom, which is affected by sex of the student. It was also discovered that the female students have a higher average point in having distractibility during and after study in the classroom than males, and that having foot pain during and after study in the classroom changes significantly according to sex.

### RECOMMENDATIONS

Since high school students spend most of their daily life at school, in various classrooms in the course of their education, it is very important that they have their education with desks and chairs that are suitable for their body posture and sitting positions while they practice activi-

ties such as reading, writing or listening. That is why classroom equipment should be adequate and suitable for the size of students. Thanks to the revision and suitable design, students' health problems will not appear and the student will be able to show the required success in his school life. Anthropometric measures should be paid attention to, and be used in designs for students so that high school students will be successful in their academic work, and the number of studies in the topic should increase.

Designers and producers should contribute to the construction of suitable study settings for students who are to benefit from these measures. When the ergonomic design of the classroom came into question, it became very important for suitable psychological and health conditions to be provided, as well as some equipment in the setting and in other areas of usage for students' which are suitable for anthropometric sizes of the students. The fact that planners of high school classrooms and the administrators at high schools pay attention to all these points in order to avoid both the negative influence on in-class performance, learning level and success of the students and various health problems and permanent disabilities which results from poor posture and sitting position in long term.

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Paper received for publication on October 2015  
Paper accepted for publication on June 2016