An Ergonomic Investigation of Working Environment with Kano Model and Universal Design Principles

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Abstract

Quality of work environment in terms of adequacy of the conditions of working offices is becoming more important each passing day for companies. It is revealed that ergonomically suitable working environment makes employee motivation increase, and that precisely has a positive effect on both human health and company interests. Kano model is a powerful tool used in the determination of design requirements for the classification of the users' degree of satisfaction, but even for this tool, a common language of phrase is needed to show what extends has to be achieved to provide these customer needs independently from individual point of views. Universal Design Principles (UDP) is a tool to evaluate products, services and the environment to make them used by everyone without needing additional design and regardless of age and skills. In this study, we propose some suggestions about ergonomic design of work environment to eliminate the factors that prevent unhealthy, inefficient and unsafe work conditions via the employment of a common language in terms of occupants' requests. We used Kano model and UDP tools and propose an integrated approach to offer an enhanced working environment. Proposed approach is validated with a real-world application, where questionnaires were prepared based on ergonomic conditions and UDP, and then the approach was evaluated with Kano Model for a large-scale public institution.

1. INTRODUCTION

Over the recent years, consideration of the ergonomic criteria while designing working offices has become even more important because it is revealed that designing suitable offices based on employee expectations will affect employee productivity in a positive way. The quality of the working environment, which is directly in relation to the productivity of employees, is a highly remarkable issue. For workers, performing duty in a comfortable working environment, which is organized in terms of expectations and desires, will help them do their duties quickly, easily, effortlessly and at high efficiency. Especially recent studies have shown that if workers are in an environment which is appropriate in ergonomic point of view and if they feel comfortable in that environment, this will positively affect their productivity, motivation, and health. Therefore, the quality of working environment needs to be handled and organized by considering ergonomic issues. However, to be able to organize the office environment in an ergonomic way, people who are the direct users of these working environments should also take part in the application with regards to providing objective advantages. Within the scope of this study, the mentioned participation was provided by questionnaires. Given that each person has different physical and mental characteristics, there is a need for a design approach that enables all products, services, and environments to be used by many people regardless of age, skill, and situation without the need for a special additional design. This design approach, which is employed in our study, is Universal Design Principles (UDP).

The main aims of the present study are to investigate the factors affecting the working environment quality in the light of UDP and to propose ergonomically meaningful suggestions for office designs by means of these factors. The study is organized as follows: the second section gives scientific literature research, the

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third section describes material-method used in the study, the fourth section shows application, and finally, the fifth section gives discussion and conclusions of the study.

2. LITERATURE REVIEW

When the related literature is reviewed, it is seen that Kano Model is utilized to classify various customer requests/preferences. The first one of these studies is Akyüz's study which aims to classify the requirements of Forest Industrial Engineering students' needs [1]. Similarly, Uca and Menteş have classified the needs of university students using Kano Modelling approach and have determined the requirements with the Analytical Hierarchy Process (AHP) method and have made suggestions to the department managers [2]. Sofyalioğlu and Tunail's study categorizes buyers' expectations about a food product using Kano Model and includes quality planning [3]. Shahin and Zairi classify the needs and priorities of people flying internationally with the help of Kano model [4]. The authors of that study conducted real time work on the customers of three different international airline companies. In addition to these studies, there are a lot of studies in the literature about the classification of customer requests with Kano Model.

In the same way, there are studies in the literature about making ergonomic interventions to office environments. Books and Klemm stated that back pain was a complaint frequently mentioned by dentists in recent years. They noted that efforts to alleviate back pain were generally focused on changing body posture, but there was no change in pain reduction despite the change. They proposed an innovative ergonomic approach which is reducing excessive use of dentist' static muscle movements [5]. Kırzıoğlu and Yetiş aimed to eliminate the risks arising from the working conditions of the dentists by performing ergonomic interventions in the dentistry clinic. Authors brought suggestions about ergonomic equipment, armchairs, and office design that dentists can use in working environments [6].

Gravina et al made ergonomic proposals to library environment. The aim of that study was to demonstrate the effectiveness of interventions related to the ergonomic and safe posture of the intended participants to improve the body posture in the office environment. The authors evaluated four independent situations of six participants. These include workstation arrangement, testing of equipment (mouse, keyboard, etc.), peer observations, and graphical feedback. The posture positions of six participants were examined during their routine work and the deficiencies observed in these examinations were tried to be solved with the help of ergonomic interventions [7].

Lewis and his colleagues evaluated the costs of skeletal muscle system diseases encountered before and after training given to company employees regarding office ergonomics in their work. They stated that the costs after training were lower [8].

Mahmud et al. stated that muscle and skeletal diseases are very intense among computer users. The authors trained employees on office ergonomics in an office environment where computer use is predominant. After employees were trained, they were observed for six months. They stated that there is a serious decrease in the musculoskeletal diseases experienced by the employees [9]. Robertson et al. aimed to investigate the effects of ergonomic interventions and training on office workers. In that study, authors examined workers by separating the office workers into three groups. In the first group, there were employees who were educated about office ergonomics and had adjustable office seats. In the second group, there were only participants who were trained about ergonomics. The third and last group was the control group. In three groups, the article authors examined body posture and workstation status in terms of ergonomic issues. Ergonomic knowledge of all participants before and after training was also tested by experts. The results of the study showed that the musculoskeletal diseases experienced by the two training groups were lower than the control group [10]. Robertson et al. also have another study which is about the office workers who are involved in office ergonomics training and have made observations before and after. And they gained similar results with the former study [11].

Because of its flexible structure, Kano model has examples of application in many different study areas in the literature. Examples of these type of studies are given as follows. Avikal et al specified that applications of Kano model, fuzzy-AHP, and (modified synthetic evaluation method) M-TOPSIS-based technique,

shown to successfully find the optimal order of component removal using AND/OR precedence relation [12]. Ghorbani et al. proposed a three-phase approach for supplier selection based on Kano model and fuzzy multi criteria decision-making. In the aforementioned study, Fuzzy Kano questionnaire and Fuzzy AHP were utilized with the aim of finding out the importance weight of the criteria [13]. Wang and Wu proposed a hybrid framework to incorporate customer preferences and customer perceptions into the decision making process of product configuration and alternative evaluation. Kano model placed in that study is utilized to elicit customer perceptions of optional attributes [14].

In light of literature survey, it is seen that the literature lacks studies that revealed the expectations of the employees in the office environment by utilizing UDP and Kano model.

3. MATERIAL METHOD

In this section, the methods utilized in this study are briefly explained. For further information, studies of Avikal et al, Ghorbani et al. and Wang and Wu can be suggested for interested readers [12-14].

3.1. Universal Design Principles (UDP)

The first method that is included in the study is the UDP. UDP are principles which are aimed at designing a product or environment that can be used without difficulty by people with disabilities or by elderly. In the concept of Universal Design Principles, there are seven main titles and their several sub-titles [15].

Main titles and what they point at can be briefly mentioned as follows [15];

1) **Equitability in use:** In this title, which is intended to use the design in the same way for people with different levels of competence, for all relevant users of the topics such as security and confidentiality need to be covered. In the same way, the design motivates all employees' desire to work.
2) **Flexibility in use:** Design should be easy to use by users who are right and/or left handed. The design should be adjustable to the user's speed of use.
3) **Simple and intuitive use:** The design should be easily understandable and usable regardless of the user's knowledge, language, abilities, and experience. The design should be far from unnecessary complexity and be compatible with the user's expectations and intuitions.
4) **Detectable information:** The design should effectively expose the information required for use regardless of the user's ability to perceive. Information required for use should be reported in the guidelines.
5) **Tolerance for error:** The design should be such that the accidents that may occur because of undesirable situations can be largely reduced. The design should include warnings with respect to the situations of errors and accidents. It should locate elements that are most commonly used and the elements that may cause danger should be isolate or eliminated.
6) **Low physical power usage:** The design should allow the user to use the product while maintaining the natural body position. It should be free from repetitive movements and very high-power usage. It should allow the user to keep physical fatigue to a minimum.
7) **Appropriate size and area for approach and use:** Regardless of the user's body measurements, the design should have sufficient space for access and use. Significant elements should be placed at an easily visible angle from sitting or standing position. The user must be able to reach all the elements in standing or sitting position.

The main purpose of the UDP used to be helping people with disabilities or old people. However, it has recently begun to be used in studies to expand the scope of its use and to ensure the same use for people with different characteristics.

3.2. Kano Model

Kano model, developed by Kano et al. in 1984, reveals the relationship between customer satisfaction and the performance of a product or service, that is, the degree to which customer expectations can be met [16]. Compared to other models, Kano model assumes that all customer requests are not satisfied at the same level; therefore, this relationship is not linear. Customer satisfaction is very high when a small improvement is made in highly valued customer needs, whereas the customer satisfaction level does not increase even though there is a big improvement in ordinary needs [17]. Kano model was used to measure the level of satisfaction of employees in this study. Kano model was included in this study with the aim of evaluating and classifying employees' expectations of the working environment. The product or service features in Kano model are divided into six groups [18].

These can be presented as follows; Main features (must-be), Expected / linear (one-dimensional), Attractive features. Over time, new features have been added to existing literature [2], such as; Indifferent requirements, Requirements that create a question mark in minds, Reverse requirements.

- **Main features:** These are the features that the customer already expects to find in the product or service. This feature group is a very important position for the customer. If this characteristic is not met, the level of dissatisfaction of the customer increases; but if satisfied, customer satisfaction does not increase. For example, the contact list capacity of a mobile phone can be considered in this group. If it is above a certain number, it will not please the buyer, but if it is below a certain number, it will cause dissatisfaction.

- **Expected / linear features:** When the customer is asked what they expect from a product or service, the customer's response determines whether the property is included in this group or not. If this feature is present in the product or service, the level of satisfaction increases, and if it does not exist, the level of dissatisfaction of the customer increases. For example, a battery indicator on the screen in a mobile phone is an expected feature.

- **Attractive features:** This feature is not expected to be found in the product or service by the customer, but it is satisfactory, if met. If not, there will be no decrease in the satisfaction level of the customer. For example, charging a mobile phone with solar energy is an exciting feature.

- **Requirements which do not make a difference:** The presence of this feature in the product or service does not make any difference on the customer side.

- **Requirements that create a question mark in minds:** This situation occurs when a feature may be misunderstood by the customer, or the question maker may fictionalize the question in a wrong way.

- **Reverse requirements:** These requirements can be demanded in positive and negative meaning at the same time by customer. For example, it may be desirable that the mobile phone screen is large and not large at the same time. The large size provides ease of use, while the small size means that the battery will last longer.

The shape of Kano model is shown in Figure 1. The horizontal axis on the chart indicates the degree to which customer needs are met. Similarly, the vertical axis indicates customer satisfaction with the product or service [19]. To evaluate the characteristics of the product or service, a survey should be conducted on the customer and the answers obtained should be evaluated in Kano model. Kano model evaluation criteria are shown in Table 1.

The answers to the questions in the survey includes the same five choices:
- 1= I like it that way
- 2= It must be that way

- 3= I am neutral
- 4=I can live with it that way
- 5= I dislike it that way

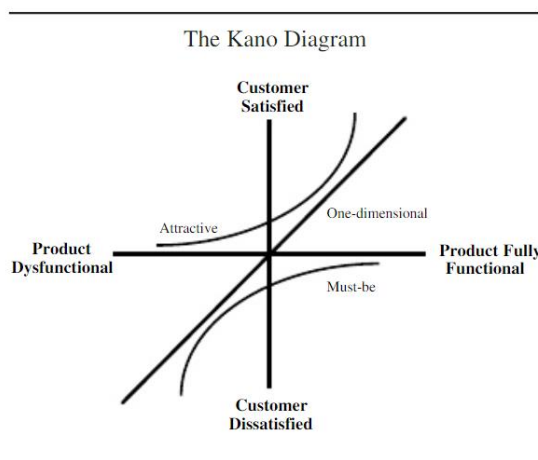**Table 1.** *Kano Model Evaluation Table[18]*

		Negative Form of Survey Questions (Non Functional)				
Positive Form of Surveys (Functional)	Customer Requirements	I like it that way	It must be that way	I am neutral	I can live with it that way	I dislike it that way
	I like it that way	Q	A	A	A	O
	It must be that way	R	I	I	I	M
	I am neutral	R	I	I	I	M
	I can live with it that way	R	I	I	I	M
	I dislike it that way	R	R	R	R	Q

$$satisfaction\ coefficient = \frac{A+O}{A+O+M+I} \qquad (1)$$

$$dissatisfaction\ coefficient = \frac{O+M}{(-1)(A+O+M+I)} \qquad (2)$$

$$W_e = \frac{1}{s}\sum_{r=1}^{s}W_{er} \qquad e=1,2,.....N; \quad r=1,2,......s \qquad (3)$$

The meaning of the letters seen in evaluation matrix of Table 1 are given as follows; A represents exciting features; M displays features that should be, O shows expected / linear properties, I expresses the properties that do not make a difference, Q symbolizes features that create question marks in minds, and finally R represents reverse features. In addition to these, importance of employee needs is symbolized with We and needs of employee importance level given by the participant r is shown by W_{er}. e is the index indicating employee needs and r is the number of participants.

Figure1. *Kano Model [18]*

After the requirements are classified according to Kano model evaluation chart, the customer satisfaction coefficient is calculated in accordance with the repetition frequency of the categories [1]. The customer

satisfaction coefficient is calculated by equation (1), and the customer dissatisfaction coefficient is calculated by equation (2). Minus sign is put on the form because customer dissatisfaction is a negative situation. When the questionnaire is being conducted, a scale of 1 to 5 has been put for identifying the importance degree of each need. Calculation of the importance degree is done with the help of equation (3).

4. APPLICATION

In this study, we have identified the needs of the employees in a public institution and the classification of the universal design principles, and finally, by the way of this classification, an adequate number of several ergonomic sense of working environments were suggested to the employees.

Classification of needs related to the working environment was done with the help of Kano Model. The study was carried out in Gazi University Faculty of Engineering, Department of Industrial Engineering. A total of 45 questionnaires were administered, 4 were not assessed due to the incomplete responses given, and 41 were evaluated. The number of surveys done was found sufficient because Griffin and Hauser found in the literature that the study they conducted was sufficient to reflect 90-95% of the 20-30 customer survey in a homogeneous segment [20]. The reliability of the answers given to the questionnaires was analyzed with SPSS 16.0 software and Cronbach's Alpha value was found as 0.729. According to Piaw, the Cronbach's Alpha values between 0.65 and 0.95 are acceptable values [21]. This value indicates that the confidence interval is at acceptable level.

Responses given to the questionnaires were transferred to the Excel file and evaluated according to Kano Model Evaluation Table shown in Table 1. The aggregated representation of the results obtained from the evaluations is shown in Table 2. According to the results obtained, 6 of the 31 needs were categorized as expected / linear, 20 of which did not make a difference, 1 was opposite, 1 was exciting, 3 were expected. Questions about how the effects of dust and noise in the working environment affect the employees were categorized as expected / linear requirements. In other words, the absence of dust and noise in the environment increases the level of satisfaction of the employee, and if it is dusty and noisy, the satisfaction of the employee decreases. The need for anthropometric suitability of the furniture used by the employees in the office was also included in the expected linear requirements category. As a large part of the work in the office is done sitting; therefore, the lumbar vertebrae are painful and rheumatic diseases that arise from stretching in the shoulders, back muscles and sitting still for a long time. For this, the issue of office regulations in ergonomics is at least as important as ergonomic regulations in industrial firms.

In Table 3, satisfaction coefficients and importance degrees of ergonomic requirements in the office environment are shown. The importance degree of the ergonomic requirements was calculated over 5. Related details about Table 3; such as the use of coefficients; are given in the *Ergonomic Recommendations for the Office Environment* part of the paper.

Table 2. *Information obtained from evaluations*

Questions	Categories						
	A	**O**	**M**	**I**	**R**	**Q**	**Frequencies**
Dust	2	19	13	6	-	1	O
Noise	3	17	9	12	-	-	O
Humid	-	-	-	27	14	-	I
Lightning	-	1	1	30	9	-	I
Anthropometric compatibility of the furniture	8	17	8	8	-	-	O
Temperature	-	1	-	10	30	-	R
Dual Screen Usage	8	6	-	24	3	-	I
Wireless hardware	6	6	-	27	2	-	I
Use in the same way as people using right or left hand	2	1	2	33	-	1	I
Personal Privacy	1	5	5	18	9	3	I
Motivation	8	15	4	14	-	-	O
Privacy	7	11	5	18	-	-	I
Get ideas from people when designing	13	10	6	12	-	-	A
Equitability in Use	2	5	1	29	4	-	I
Modification in work environment	8	4	2	26	1	-	I
Right and left- hand use	6	4	-	31	-	-	I
Individuality in the use of equipment	6	10	13	12	-	-	M
Useful working environment	7	15	5	14	-	-	O
Appropriateness to expectations and habits	13	6	4	18	-	-	I
Giving ınformation for equipment use	6	7	5	23	-	-	I
Equal usage of equipment for all employees	8	6	3	23	1	-	I
Obstruction of hazardous sources by design	2	13	15	11	-	-	M
The presence of caution signs in the working environment	4	7	3	27	-	-	I
Simplicity in the work environment	5	7	3	26	-	-	I
Ergonomic compatibility of office furniture	5	17	5	15	-	-	O
Energy usage	4	6	2	29	-	-	I
Presence of frequent and repeated jobs	3	10	5	23	-	-	I
Continuous use of physical force	1	10	16	12	2	-	M
Sufficient space for equipment use	3	11	5	22	-	-	I
Access to tool equipment in sit position	10	6	1	24	-	-	I
Viewing angle while sitting position	5	4	-	32	-	-	I

Table 3. *Satisfaction coefficients and importance degrees*

Requirements	Satisfaction coefficient	Dissatisfaction coefficient	Sum of coefficients	Importance Degree
Dust	0,525	-0,800	-0,275	4,561
Noise	0,488	-0,634	-0,146	4,098
Humid	0,000	0,000	0,000	3,39
Lightning	0,031	-0,063	-0,031	3,829
Anthropometric compatibility of the furniture	0,610	-0,610	0,000	4,561
Temperature	0,091	-0,091	0,000	4,317
Dual Screen Usage	0,368	-0,158	0,211	3,098
Wireless hardware	0,308	-0,154	0,154	3,098
Use in the same way as people using right or left hand	0,079	-0,079	0,000	3,146
Personal Privacy	0,207	-0,345	-0,138	4,171
Motivation	0,561	-0,463	0,098	4,341
Privacy	0,439	-0,390	0,049	3,951
Get ideas from people when designing	0,561	-0,390	0,171	4,098
Equitability in Use	0,189	-0,162	0,027	3,415
Modification in work environment	0,300	-0,150	0,150	3,537
Right and left- hand use	0,244	-0,098	0,146	3,073
Individuality in the use of equipment	0,390	-0,561	-0,171	4,049
Useful working environment	0,537	-0,488	0,049	4,098
Appropriateness to expectations and habits	0,463	-0,244	0,220	3,585
Giving information for equipment use	0,317	-0,293	0,024	3,805
Equal usage of equipment for all employees	0,350	-0,225	0,125	3,805
Obstruction of hazardous sources by design	0,366	-0,068	-0,317	4,512
The presence of caution signs in the working environment	0,268	-0,244	0,024	3,829
Simplicity in the work environment	0,293	-0,244	0,049	3,561
Ergonomic compatibility of office furniture	0,524	-0,524	0,000	4,366
Energy usage	0,244	-0,195	0,049	4,024
Presence of frequent and repeated jobs	0,317	-0,366	-0,049	3,732
Continuous use of physical force	0,282	-0,667	-0,385	4,000
Sufficient space for equipment use	0,341	-0,390	-0,049	3,902
Access to tool equipment in sit position	0,390	-0,171	0,220	3,707
Viewing angle while sitting position	0,220	-0,098	0,122	3,317

4.1. Ergonomic Recommendations for the Office Environment

The illnesses that can occur as a result of wrong postures in the offices are divided into 4 groups [22];
1) Musculoskeletal system diseases
2) Circulatory system diseases
3) Allergic diseases
4) Psychological diseases

These diseases cause loss of efficiency in the office environment and the cost factor has a negative impact on overall company success. Based upon the information obtained from the survey results with the aim of preventing this loss of productivity and cost, a number of suggestions were made to the institution where the questionnaire was made. These proposals are related to the placement of office furniture, thermal comfort, noise, and instrument and equipment. The most time- consuming area in the office environment is the working desk and the computer is also a limited area.

It is also important to arrange the most commonly used parts of this area. It is recommended that the most used equipment should be kept in the arm diameter in the arrangement of the work desk. It is known that for a person in an office, the volume must be at least 12 m^3 in order for the employee to feel comfortable. The table and the chair need to be placed at a certain distance from the wall so that the chair can be pushed back while getting up and can be raised without hitting the table or the seat.

As it is known, the main purpose of ergonomics is to ensure that human being is in harmony with work. For this reason, it is an important necessity to consider human dimensions in terms of anthropometric aspects in the arrangement of office environments. The natural position of the body, the hand and arms, the area of motion of the joints are important points to be considered in this regard. When the anthropometric dimensions are determined in the design of any working environment, the upper and lower limits of the dimensions are adjusted to 90% of the persons working in that environment that is 90% of the normal distribution. Adjustable items are used in the remaining 10%. The performance criteria considered in ergonomics are continuous performance that can be maintained for a long time. When a workspace is ergonomically designed, it is expected to actually contribute positively the long-term continuous performance. Ergonomically speaking, it would be wrong to think of tables and chairs alone. Both must be compatible with each other and then fit the user. It is expected that the chair will be able to go back and forth, rotate 360 degrees, adjust height, support waist gap, and adjust back support. The seating area must be covered with air permeable material. According to the height of the seat of the table, the user should be able to lift the hump from the seating position and at the same time be at a level high enough to prevent the contraction of the shoulder muscles. It is recommended that the position of the table and chair should be such that the user does not lose the natural posture. Monitor should be exactly opposite to the user so that one can work in an efficient way in terms of ergonomic rules. Screen reflections cause headaches, glare and disturbances. For this reason, the monitor and the keyboard must be customized to the user. The screen must be placed in a way that the reflections are blocked, with a distance of 50-80 cm between the user and the monitor. The placement of the monitor should be such that the upper limit is below the eye level of the user. Office furniture must be adjustable to workers in terms of anthropometric in order to prevent static work and to remove constant muscle contractions.

Given that all employees do not have the same physical characteristics, having office furniture that is adjustable is an important issue. In offices, very dry air can cause discomforts such as lung irritations, cold respiratory tracts, cold spots, and dryness in the eyes. To be able to provide thermal comfort, it is necessary for the office staff to provide air conditioning devices and ventilate the office every day.

The suggestions made to the firm are as follows:
- Placement of office furniture in an anthropometric sense to fit employees,
- Noise sources being blocked on the spot if possible, if not, eliminate the noise source,
- Placement of the office equipment in a manner that minimizes the continuous use of physical force,
- Placement of the screens to prevent reflections in environments where more than one person is working,

- Shared equipment can be placed at the same distance that people can access,
- Removal of distracting elements

If their back, neck, shoulders, and back pain are not overcome with all these suggestions, employees are advised to do office exercises to reduce the pain [23].

In case of working on a very high chair, the knee and calf muscles; and in very wide seats, shoulder and neck become uncomfortable. In addition, in the case of forward inclined seating end up with back pain and disc wear [24]. If these parts of the body are uncomfortable and exposed to this illness for a long time, it will lead to permanent occupational diseases in the future. For this reason, it is necessary to make re-regulations in the design of office environments to minimize the work in static condition. This was taken into consideration when presenting suggestions to office environments in this study. Motivation is the most important factor that affects the level of work done, that is, the productivity of the person. As far as we understand from the analysis of the problem pointing at the motivation from Kano questionnaire, workers put the need to design their office environments in a way that will stimulate work in linear categorization. Other requirements that employees include in this category are; the usefulness of the working environment and the ergonomic adaptation of office furniture. Categories that do not make a difference are the categories in which they enter conditions such as humidity, lighting, dual screen use, wireless use, right and left use cases, personal privacy, privacy, making changes in the working environment, being informed about tool equipment usage. The results of the study suggest that it is exciting to ask employees' ideas in the design of office environments. The result is that there is no change in satisfaction when the employees are not asked about their opinions, and when their opinions are asked, the satisfaction ratings increase.

The three features that employees expect to be in the office environment are; being subjectively responsible for the use of the equipment and tools they use (such as finding where they last left off), attempting to avoid potential hazards in the design, and minimizing the use of continuous physical force in design. When it comes to thermal comfort, the ambient temperature of the office environment should be between 20 and 24°C in winter and 21°C in summer. Humidity must not exceed 50%. People who are out of these conditions feel uncomfortable and their productivity decreases with increasing discomfort. For example, when the air temperature exceeds 24°C, it is observed that people are easily annoyed with concentration disorders, mental activities related performance falls. Increase in work-related accidents, excessive fatigue, decreased performance in jobs without skill, but increased job accidents. The issue of providing thermal comfort in the design of the working environment is an important point. And in the survey study, when the answer to the question about temperature is analyzed, it was seen that the temperature of the office environment entered into the group of requirements that create the contradiction. Thus, this requirement is the desired feature whether it is by the employee or not.

Since most of the requirements have been identified as non-discriminatory, it has been decided with the help of the customer satisfaction coefficient that the needs are closer to the exciting group or to the expected group (See Table 3). If the sum of the coefficients is greater than zero, it is exciting, while if it is less than zero, it is closer to the group of expected requirements. In light of this information; according to the Table 3, it has been determined that they are close to entering the required group; the lighting, personal confidentiality, frequent and repetitive tasks, sufficient space for the use of equipment. Likewise, in the group that does not make a difference with the initial evaluation, requirements such as the use of a double screen, wireless hardware, privacy, equal use, change in working environment, right and left-hand use, design conformity with expectations and habits are more prone to enter the group of exciting requirements. When the employees interpret the importance ratings they give to the need groups, the highest value and the most important requirement are the chair-table anthropometric conformity and the dust situation. These requirements are designed to motivate the office's desire to work, the prevention of hazardous sources by design, and the monitoring of temperature conditions. The least important aspect of the employees' needs in the needy groups is that the designs are arranged according to the right and/or left handed users, the view position in the sitting position, the double screen, and the wireless hardware cases.

5. RESULTS AND DISCUSSION

When the results of the work are generally interpreted, it was found that the most important feature for the workers in the office environment is the ergonomic suitability of the furniture they use. For employees, while office design is being done, asking about employees' ideas was included in the category of exciting needs. Moreover, in terms of importance, this requirement had a value above four. Therefore, employees put this need into the "very important" category. In the same way; it was seen that "unfit for the right and left- handed people" and "the position of sight in sitting position" that the employees regarded as unimportant were included in the "requirements which do not make a difference" headings. In this study, the requirements of the employees in the office environment were evaluated on the basis of UDP and ergonomics with the help of Kano model, the needs were classified and customer satisfaction coefficient and importance ratings were calculated. Ergonomic suggestions, which are based on these classifications and calculations, were made for office environments.

CONFLICTS OF INTEREST

No conflict of interest was declared by the authors.

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