How Optimal is the Visual Display Terminal (VDT) Work Station at the Faculty of Public Health, Universitas Airlangga

Seberapa Optimal Stasiun Kerja Visual Display Terminal (VDT) di Fakultas Kesehatan Masyarakat, Universitas Airlangga

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ABSTRACT

Introduction: The academic and student affairs department in the administration room of the Faculty of Public Health of Universitas Airlangga works using a Visual Display Terminal (VDT) with a sitting work position that has the potential to cause eye strain and several muscular disorders. This study aimed to describe the work station of VDT users in the administration room of the Public Health Faculty, Universitas Airlangga. **Method:** This research was an observational research using cross-sectional descriptive design. The population was the users of the VDT in the administration room of the Public Health Faculty, Universitas Airlangga, as many as 11 people. The sample used was total population. Data were collected using an observation sheet and then was analyzed descriptively. **Result:** The head position of all workers were optimal (100.0%); the majority of workers' visibility was optimal (54.5%); all table heights were optimal (100.0%); most of the elbow angel and keyboard position was not optimal (63.6%); the majority of mouse positions were optimal (54.5%); chair heights were not optimal (100.0%); most of the backrest and waist angle was optimal (72.7%); most of the workers' knee angles were not optimal (81.8%); most of the legroom were optimal (81.8%); all workstations did not have footing and document holders (100.0%), so they were considered not optimal. **Conclusion:** Most of the elements is considered as optimal, but some elements are not optimal, including elbow angle, the keyboard position, chair height, knee angle, footing, and document holder.

Keywords: work station, sitting work position, visual display terminal

ABSTRAK

Pendahuluan: *Pekerja bagian akademik dan kemahasiswaan pada ruang administrasi Fakultas Kesehatan Masyarakat, Universitas Airlangga, bekerja menggunakan Visual Display Terminal (VDT) dengan posisi kerja duduk yang berpotensi menyebabkan ketegangan mata dan beberapa gangguan otot. Penelitian ini bertujuan untuk mendeskripsikan stasiun kerja pengguna VDT di ruang administrasi Fakultas Kesehatan Masyarakat, Universitas Airlangga.* ***Metode:*** *Penelitian ini merupakan observasional dengan rancang bangun cross-sectional deskriptif. Populasi merupakan pengguna VDT di ruang administrasi Fakultas Kesehatan Masyarakat, Universitas Airlangga, sebanyak 11. Sampel yang digunakan adalah total populasi. Data dikumpulkan menggunakan lembar observasi dan dianalisis secara deskriptif.* ***Hasil:*** *Semua posisi kepala pekerja sudah optimal (100,0%); sebagian besar jarak pandang pekerja sudah optimal (54,5%); semua tinggi meja sudah optimal (100,0%); sebagian besar posisi sudut siku dan posisi keyboard tidak optimal (63,6%); sebagian besar posisi mouse sudah optimal (54,5%); tinggi kursi tidak optimal (100,0%); sebagian besar sudut sandaran punggung dan pinggang sudah optimal (72,7%); sebagian besar sudut lutut pekerja tidak optimal (81,8%); sebagian besar ruang untuk kaki sudah optimal (81,8%); semua stasiun kerja tidak memiliki alas kaki dan document holder (100,0%), sehingga dinilai tidak optimal.* ***Simpulan:*** *Sebagian besar unsur dinilai sudah optimal, namun terdapat beberapa unsur yang tidak optimal, yaitu sudut siku dan posisi keyboard, tinggi kursi, sudut lutut, alas kaki, dan document holder.*

Kata kunci: *desain stasiun kerja, posisi kerja duduk, visual display terminali*

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INTRODUCTION

The Visual Display Terminal (VDT) is a device that can be used to view and input data using a keyboard and is usually called as a computer.

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However, the VDT has recently developed, not only as computers but it can be in the form of laptops and smartphones. As the time goes by, VDT is more needed. Thus, the risk of terminal computer and visual display syndrome will also increase (Parihar et al., 2016).

The administration room of the Public Health Faculty, Universitas Airlangga, was contained of several departments, among other workers in the academic, student affairs, also facilities and infrastructure department at the faculty level. Researchers only assessed the academic and student affairs department workers because they used VDT continuously. The academic and student affairs department workers had the task of managing academic and student-related data at the faculty level, for example, making student absences, typing letters, also managing data both soft files and hard files. Workers used the VDT for about 6-8 hours and worked in a sitting position.

Sitting work positions have its advantage and disadvantage. The advantage of a sitting work position includes loading the leg so that less energy is expended and the need for blood circulation can be reduced. However, sitting for too long causes the abdominal muscles to become soft and the spine will bend so they get tired quickly (Tarwaka, 2015). Besides duration, the disadvantage of sitting work position also depends on the condition of the work station. Based on the researchers' observations, there was a worker who used neck pads. The worker stated that her work caused neck pain. In addition, there were workers who complain that they feel pain in shoulders when typing for a long time. Not only complaints of pain in limbs, there was also a complaint regarding the work station element that the chair's condition was difficult to adjust even though the type of chair was adjustable chair. Thus, workers cannot adjust the chair's height to the employee's body. This could cause workers to get tired quickly and experience muscle disorders in the shoulder.

A good work station does not cause neck complaints (Keown and Tuchin, 2018). Workers will feel pain in the same limb if the condition of work station was the same (Jalilpour et al., 2020). Losses will increase if working sitting using the VDT. It will also cause eye problem risk related to computers in addition to getting various kinds of musculoskeletal disorders (Pradnyawati, Tunas and Natalia Yudha, 2017; Pandey et al., 2020). Furthermore, the use of VDT for a long time (6-11 hours per day) causes physical complaints, work stress, and work fatigue (Cheng et al., 2019).

There are several studies on the use of computers or VDT that was not ergonomic or exceeds permissible time limit in Indonesia. For example, a research conducted by Irma, Lestari, and Kurniawan (2019) stated that there was a relationship between monitor distance, age, and duration of computer use with subjective complaints of eye fatigue. A research conducted by Anjanny, Ferusgel, and Siregar (2019) stated that there was a relationship between improper sitting position and length of work with the occurrence of Musculoskeletal Disorders (MSDs). A research conducted by Nopriadi et al. (2019) stated that there was a relationship between monitor position, lighting, work station, and duration of work with the occurrence of Computer Vision Syndrome (CVS). However, there is not much research on the design assessment of work stations using VDT users.

The administration room of the Public Health Faculty, Universitas Airlangga, used an open office layout design or an open work space (there are no boundaries between labor desks and the working platform had the same height for all workers). It means that there are no boundaries between departments in this room. The work station of VDT users in the administration room of the Public Health Faculty, Universitas Airlangga, has several equipment including a computer desk, work chair, monitor, keyboard, and mouse. Work station arrangement is very important to create comfort in VDT working. For example, providing a work desk that has enough space to place some VDT equipment, a neutral perspective so that the neck does not look up, foot stomping as a means of relaxation so that the feet do not get tired easily, placing items that are often used close to the user, adjusting the workplace lighting as optimal as possible so that monitor light does not disturb the user, and placing necessary documents when using the computer close to the monitor (Suhardi, 2015; Tarwaka, 2015).

Research on evaluating or assessment of the design of VDT work stations was rarely found in Indonesian journals. Meanwhile, research on the risk assessment of using VDT has been carried out, for example, research conducted by Siboro (2019) to evaluate the risk of possible musculoskeletal disorders using the Rapid Office Strain Assessment (ROSA) method on computer users and research conducted by Restuputri, Puspita and Mubin (2019)

to measure the work risk and physical environment using the ROSA method. Even though the work stations assessed in this study had the same table, chairs, and several facilities considering the concept of the room being assessed is an open office, the results of the assessment were not necessarily the same because each worker can modify or adjust the equipment at the work stations as their needs, so the condition of the work station would be different. Thus, the purpose of this research was to describe the work station of VDT in the administration room of the Public Health Faculty, Universitas Airlangga, in accordance with the results of observations.

METHOD

This research was an observational type because researchers only observed the object of the research. The design of this study was cross-sectional description because the study was carried out at one time and only analyzed descriptively, which was how the comparison between the results of work station evaluations by Visual Display Terminal (VDT) users in the administration room of the Public Health Faculty of Universitas Airlangga, and the existing standards. The population of this research was the academic and student affairs departments' workers that used VDT continuously in the administration room of the Public Health Faculty, Universitas Airlangga. The sample of this study was total population, as many as 11.

The primary data collection used an observation sheet instrument created by researchers based on several sources. There were several elements assessed by the researcher, each element has two rating scales, namely optimal and not optimal. Optimal and not optimal assessments were based on the appropriateness between the size of the elements in the workplace and the standards or references used. The measurement of the size of elements used a ruler and arc. The element of head position was based on American National Standards Institute (ANSI/HFES-100) (Woo, White and Lai, 2016); visibility, elbow angle and keyboard position, mouse position, chair height, knee angle, legroom, and document holder was based on the Regulation of Ministry of Manpower of the Republic of Indonesia Number 5 of 2018 (Menteri Ketenagakerjaan Republik Indonesia, 2018); while table height, backrest and waist angle, and footing based on Ergonomi Industri book (Tarwaka, 2015). Researchers used the word “optimal/not optimal” and “does not appropriate/not appropriate” because the existing standard measures uses range, which means that the size in the standard range is the best value after several studies conducted. Elements related to anthropometry, for example chair height and table height was based on sources from Indonesia which have considered Indonesian anthropometry (Tarwaka, 2015; Menteri Ketenagakerjaan Republik Indonesia, 2018). Meanwhile, secondary data was collected by literature review, looking for references either from books, journals, and government regulations related to the appearance of ergonomic work station terminals.

The data analysis was in the form of description because the researcher needed to describe the VDT work station. Data collection was carried out in September 2019 in the Administration Room of the Public Health Faculty of Universitas Airlangga. This study has obtained ethical permission under number 381-KEPK in 2018.

RESULT

The following is the results of the assessment of several elements of Visual Display Terminal (VDT) work station in the administration room of the Public Health Faculty, Universitas Airlangga.

Head Position

The optimal head position is the position where the head does not look down or up. The head position was determined from the point of view of the eye to the monitor (visual angle). Supposedly, the optimal visual angle is 15o-25o below the sitting eye level (Woo, White and Lai, 2016). Based on the results of the assessment, all head positions of the academic and student affairs department workers at the Public Health Faculty, Universitas Airlangga, were optimal (100.0%) with the average visual angle to the monitor was 18o. It means that there was no worker whose head was looking down or up while working.

Visibility

The second element is visibility. The intended visibility is the distance from the eye to the monitor screen. The optimal distance is 45-60 cm (Menteri Ketenagakerjaan Republik Indonesia, 2018). Based on the results of the assessment, most of the visibility of the academic and student affairs department workers of the Public Health Faculty, Universitas Airlangga was optimal (54.5%) with the average of 57 cm.

Table 1. The Frequency of Assessment of Each Visual Display Terminal (VDT) Work Station Element in the Administration Room of the Public Health Faculty, Universitas Airlangga, in September 2019

Element	Standard	Min	Max	Average	Assessment			
					Optimal		Not Optimal	
					n	%	n	%
Head Position	15°-25°	15°	20°	18°	11	100.0	0	0.0
Visibility	45-60 cm	45 cm	66 cm	57 cm	6	54.5	5	45.5
Table Height	58-71 cm	68 cm	68 cm	68 cm	11	100.0	0	0.0
Elbow angle and keyboard position	≥ 90°	70°	90°	82°	4	36.4	7	63.6
Mouse position	close to keyboard	-	-	-	9	81.8	2	18.2
Chair Height	60-65 cm	45 cm	53 cm	49 cm	0	0.0	11	100.0
Backrest and waist angle	100°-119°	80°	125°	102°	8	72.7	3	27.3
Knee angle	90°	70°	98°	83°	2	18.2	9	81.8
Legroom	available	-	-	-	9	81.8	2	18.2
Footing	available	-	-	-	0	0.0	11	100.0
Document Holder	available	-	-	-	0	0.0	11	100.0

Table Height

The table for VDT users in the administration room of the Public Health Faculty, Universitas Airlangga, has two parts; the first is a place for computer monitor and the second is located right below the first to place the keyboard. The table height element was measured from the floor until the keyboard platform. The height of the table is considered optimal if its height is at the range of 58-71 cm and is considered not optimal if the height of the table is less than 58 cm or more than 71 cm (Tarwaka, 2015). Based on the results of the assessment, all table heights at the VDT work station in the administration room of the Public Health Faculty, Universitas Airlangga, were optimal (100.0%).

Elbow Angle and Keyboard Position

The fourth element is elbow angle and keyboard position. If the elbow angle of worker when working on a computer is > 90°, then the position is optimal. This element is related to the keyboard position; the optimal keyboard position is parallel to or below the elbow (Menteri Ketenagakerjaan Republik Indonesia, 2018). Based on the results of the assessment, most of the elbow angles and keyboard positions of the academic and student affairs department workers of the Public Health Faculty, Universitas Airlangga were not optimal (63.6%) with the average of 82o.

Mouse Position

The next element assessed was mouse position. It is considered optimal if the mouse position is close and on the same surface as the keyboard. Based on the results of the assessment, most of the mouse position in the VDT work station in the administration room of the Public Health Faculty, Universitas Airlangga, were close to the user and were on the same surface as the keyboard, thus, they were optimal (54.5%).

Chair Height

The type of chair used in the administration room of the Public Health Faculty, Universitas Airlangga is an adjustable chair. Chair height is considered optimal if it is between 60-65 cm (Menteri Ketenagakerjaan Republik Indonesia, 2018). Based on the results of the assessment, all of chair heights of the academic and student affairs department workers at the Public Health Faculty, Universitas Airlangga were not optimal (100.0%) with the average of 49 cm.

Backrest and Waist Angle

According to Tarwaka (2015), the backrest and waist must be supported naturally with inclination angles of 100o-119o. Based on the results of the assessment, most of the backrests of the academic and student affairs department workers of the Public Health Faculty, Universitas Airlangga were optimal (72.7%) with the average of 102°.

Knee Angle

The knee position at work is considered optimal if it is perpendicular enough or the angle is 90^{o}. The knee position angle cannot be optimal if the chair height does not match the length of the worker's leg (Menteri Ketenagakerjaan Republik Indonesia, 2018). Based on the results of the assessment, most of the knee angles of the academic and student affairs department workers of the Public Health Faculty, Universitas Airlangga were not optimal (81.8%) with the average of 83o.

Legroom

The ninth element is legroom. If there is room under the table for legs, then it is considered optimal (Menteri Ketenagakerjaan Republik Indonesia, 2018). Based on the results of the assessment, the element of legroom is optimal because most of the VDT work station in the administration room of the Public Health Faculty, Universitas Airlangga, had legroom under the table (81.8%).

Footing

The next element is footing. The availability of footing will ease the burden on the foot and make the feet become more relaxed. Assessment of footing is considered optimal if there is footing (Tarwaka, 2015). Based on the results of the evaluation, all of the VDT work stations in the administration room of the Public Health Faculty, Universitas Airlangga, did not have footing, so they were considered not optimal (100.0%).

Document Holder

The last element is the availability of document holders. It is considered optimal if there is a document holder (Menteri Ketenagakerjaan Republik Indonesia, 2018). Based on the results of the assessment, all of the VDT work stations in the administrative room of the Public Health Faculty, Universitas Airlangga did not have document holders (100.0%).

DISCUSSION

Head Position

Some standards have different sizes, for example the Australian Standard (AS-3590.2) limits 32o-45o below the eye level, the Canadian Standards Association CAN/CSA Z412-M89 limits 45o below the eye level, and the American National Standard Institute ANSI/HFES-100 limits 15o-25o below the eye level. Some publications recommend a mid-position interval of 15o-25o below the eye level. From these three standards, all standards limit the height of the monitor not to be above the eye level because the head will look up, increase the ocular surface area, and increase visual fatigue (Woo, White and Lai, 2016). This is in line with one of the anthropometric considerations which states that work visually should be as high as eye level (Tarwaka, 2015).

All monitors at the VDT work station in the administration room of the Public Health Faculty, Universitas Airlangga had an optimal height parallel to the sitting eye level and the visual angle of the worker was at the optimal interval which was around 15o-20o with the average of 18o below the sitting eye level. Each monitor had a different slope that can affect the visual angle because each worker adjusted the slope with a view that was comfortable for them. However, apart from that, there was no tip of the monitor that exceeds the eye level of the VDT workers in the administration room of the Public Health Faculty, Universitas Airlangga. Thus, this condition shows that the head position of the workers when using computer was optimal.

Visibility

The eye that functions as the human sense of sight is very valuable. Visibility is related to the human eye and computer monitor. One of research projects shows that there was a relationship between monitor distance and subjective complaints of eye fatigue on computer users (Irma, Lestari and Kurniawan, 2019). Computer users should set the worktable in such a way that it can work with an ideal viewing distance, which is > 50 cm (Irma, Lestari and Kurniawan, 2019). Users of VDT with normal vision ability experience greater eye fatigue due to visibility of around 50 cm rather than 100 cm (Woo, White and Lai, 2016). However, the characteristics of the monitor screen including the size of the monitor screen, the type of work, and the individual's ability to see must also be considered in determining the optimal distance for VDT users (Woo, White and Lai, 2016; Irma, Lestari and Kurniawan, 2019). Based on ISO-9241, VDT user visibility is better if it is more than 40 cm (Woo, White and Lai, 2016).

The standard of visibility assessment in this research was based on the Regulation of Ministry

of Manpower of the Republic of Indonesia Number 5 of 2015 that the distance recommended between the eyes and the monitor is 45-60 cm. Based on the results of the assessment, most of visibility of the academic and student affairs department workers of the Public Health Faculty, Universitas Airlangga, was optimal (54.5%) was around 45-60 cm. The eyes are at rest from accommodation when the distance between the eyes and the computer screen is 50 cm (Nopriadi et al., 2019). Meanwhile, another small portion of sample had visibility which were not optimal (45.5%), since it was less than 45 cm. If the distance from the eye to the monitor is less than 45 cm, the eye will work more because it is too close which can increase the risk of eyestrain, fatigue, and other vision problems (Menteri Ketenagakerjaan Republik Indonesia, 2018). Eyestrain is also affected by the level of glare and several other factors such as blinking frequency or worker's behavior even though the work station is optimal (Mork et al., 2020).

The average length of work of the academic and student affairs department is around 6 hours per day. Based on the research conducted by Nopriadi et al., 2019, it was stated that there was a relationship between visibility and length of work with the incidence of Computer Vision Syndrome (CVS). The use of computers for more than 4 hours per day is at risk of CVS including dry eyes (Thatte and Choudhary, 2020). However, optimal visibility in the same working conditions duration can reduce CVS (Nopriadi et al., 2019). In each use of the computer for 30 minutes, workers are advised to rest for 5 minutes. This can reduce eye symptoms and prevent muscle and bone tension, so the work is efficient (Parihar et al., 2016).

Table Height

The administration room of the Public Health Faculty, Universitas Airlangga, had an open office concept, so that the height of the work tables was the same which was 68 cm. Thus, all table height was optimal (100.0%), since it was between 58 and 71 cm. This standard is based on the height range of Indonesian elbows (Tarwaka, 2015). This is in line with the height standard table in the Regulation of Ministry of Manpower of the Republic of Indonesia Number 5 of 2015 that the table height for the sitting position shall be adjusted to the height of the sitting elbow and the work (Menteri Ketenagakerjaan Republik Indonesia, 2018). The table in administration room of the Public Health Faculty, Universitas Airlangga cannot be adjusted (fixed). So, the chair must be adjusted so that the elbow's position can be in optimal condition. However, in reality, the chair is difficult to set so that most elbow positions are not optimal. Thus, it can cause the shoulders raised.

The condition of the table is clean and most of the equipment on the table has been arranged neatly. Workers have placed items that are often used close to workers so that they are easily taken. The layout of the work tables was arranged neatly, each work station facing each other, it means that the backside of the computer meets the back of the other computer. However, there is a drawback, which the storage of hard file documents which is not enough, so there are workers who place documents at the bottom of the table that should be functioned as foot space.

Elbow Angle and Keyboard Position

Not all workers placed their keyboards according to the available place, so the results of the assessment of the elbow angle when working was vary, although the height of the table was in accordance with the height of the sitting elbows. Some guidelines state that the elbow angle should be bent at 90o when using the keyboard (Woo, White and Lai, 2016). Thus, the optimal angle of the elbow is ≥ 90o which means that the elbow is parallel to or higher than the work table (especially the keyboard case) so that the upper arms naturally rest without burdening the shoulders (Menteri Ketenagakerjaan Republik Indonesia, 2018). If the keyboard position is on a different surface from the work table, it should be placed in a lower place. So as to reduce shoulder and arm muscle tension and to make the workers do not get tired easily (Restuputri, Puspita and Mubin, 2019).

Based on the results of the assessment, most of the elbow angle of the academic and student affairs department workers of the Public Health Faculty, Universitas Airlangga was not optimal (63.6%), since it was less than 90o. This was because the height chair was not optimal and most of the workers put the keyboard out of place, that was on the same surface as the monitor. Thus, the arm was raised slightly upwards because the keyboard was a little bit thick even though the height of the table was in accordance with the height of the elbow. This inappropriate work position can increase the incidence of musculoskeletal disorder like neck pain (Pandey et al., 2020). Meanwhile, another small portion (36.4%) had formed an optimal angle of the

elbow, namely the arm was held at ≥ 90o because the keyboard position was in the place provided. The advantage of optimal keyboard position is that the shoulders will relax and not be lifted up so that the workers will not get tired easily (Menteri Ketenagakerjaan Republik Indonesia, 2018).

Based on the Regulation of Ministry of Manpower of the Republic of Indonesia Number 5 of 2015, the keyboard must be placed in the direction of the monitor. In addition, the use of a good keyboard will also reduce excessive emphasis on the keyboard keys (Menteri Ketenagakerjaan Republik Indonesia, 2018). At the Administration Room of the Public Health Faculty, the placement of the keyboard was in line with the monitor and the keyboard condition was still good.

Mouse Position

Based on the Regulation of Ministry of Manpower of the Republic of Indonesia Number 5 of 2015, the mouse position should be close and on the same surface as the keyboard so that it can be reached easily without having to move the hand too far after typing if workers want to change the cursor on the screen. Thus, the mouse position should also be at a height parallel to the elbow or below the elbow and next to the keyboard (Mohamad and Rahman, 2018). The results of the assessment of the mouse position elements in the VDT work stations in the administration room of the Public Health Faculty, Universitas Airlangga were mostly optimal (81.8%); it was close to the user and located on the same surface as the keyboard.

There were workers who put keyboard in its place, but the mouse was placed on a table surface which was certainly different from the keyboard surface. Thus, as much as 18.2% of the mouse position in the VDT work stations in the administration room of the Public Health Faculty, Universitas Airlangga was not optimal, which was far and on a different surface from the keyboard. This causes the hands to be stretched to a different place. So that, it causes a state of tension and muscle fatigue, as well as workload (Menteri Ketenagakerjaan Republik Indonesia, 2018; Restuputri, Puspita and Mubin, 2019).

Chair Height

Chairs placing is very important for workers who use computers. An ergonomic chair will affect good posture (Samudera, Muliarta and H.A, 2019). When typing, the workers' legs should lie flat on the floor. If it cannot rely on the floor, it means the chair is too high for the workers (Suhardi, 2015).

Australian standard (AS-3590.2) sets the seat height for typing and writing jobs to be between 38 and 51 cm. According to the Canadian Standards Association (CAN/CSA Z412-M89), the standard for seat height should be between 38-52 cm. Based on the American National Standards Institute (ANSI/HFES-100), it should be between 38-56 cm (Woo, White and Lai, 2016). Whereas based on the Regulation of Ministry of Manpower of the Republic of Indonesia Number 5 of 2015, the chair height for men is recommended to be 60 cm and women is 64.5 cm because women tend to use high heels (Menteri Ketenagakerjaan Republik Indonesia, 2018).

This research used the standard of the Regulation of Ministry of Manpower of the Republic of Indonesia Number 5 of 2015. Based on the assessment, all chair height of the academic and student affairs department workers were not optimal (100.0%). This can be caused by chairs that were difficult to adjust or the worker indeed setting up high like that. In fact, the type of chair was an adjustable chair, but it was so difficult to adjust because of some damages. So, that it can have an effect on the knee angle that is not natural. These results were consistent with knee angle results which show that most of them were not optimal because it can be affect by non-optimal chairs.

In addition, the chairs in the administration room of the Public Health Faculty, Universitas Airlangga were equipped with handles and wheels but were not in good condition because it had been used for a long time. The solution is to repair the damage or provide a new chair or provide footing for the worker of VDT users to work comfortably because the chair height that was not optimal can cause musculoskeletal pain in workers (Suhardi, 2015; Sant et al., 2017).

Backrest and Waist Angle

The chair in the VDT work station at the administration room of the Public Health Faculty, Universitas Airlangga used a backrest. If the workers worked by leaning their backs on the backrest, then it would form a waist angle that can be assessed. Waist angle is the size of the spine in a natural state when sitting, which would certainly form an angle of > 90o if there is a backrest with a certain slope. A waist angle of < 90o will cause fatigue and discomfort. The best way to reduce disk pressure is to form a waist angle of 110o. However, based

on a study, the best choice of waist angle to reduce muscle activity is 120o because at an angle of 130o it causes excessive muscle activity (Woo, White and Lai, 2016). The waist and back will be supported neutral at an inclination angle of 100^{o} to 119^{o} (Tarwaka, 2015).

Based on Australian standards (AS-3590.2), the recommended waist angle is 100o-120o. Meanwhile, according to the Canadian Standards Association (CAN/CSA Z412-M89), it is between 95^{o}-110^{o}. American National Standards Institute (ANSI/HFES-100) sets a waist angle of 90^{o}-120^{o} (Woo, White and Lai, 2016).

The researchers used standard from Tarwaka (2015) in the assessment of the backrest and waist angle (100^{o}-119^{o}) because this value is the middle value of several standards. Results showed that most of the backrest and waist angle of the academic and student affairs department workers at the Public Health Faculty, Universitas Airlangga, were optimal (72.7%). Optimal backrest and waist angle reflects a good sitting posture so as to reduce the risk of musculoskeletal disorder (Kumalapatni, Muliarta and Dinata, 2020). However, to state whether the sitting posture is good or not, one must also pay attention to the conditions of other work station elements. Improvements to all elements of the work station ergonomic can naturally create a good sitting posture (Swinton, Cooper and Hancock, 2017).

The other small frequency did not form an optimal angle for several reasons, for example, the thighs were not straight because the chair was too low or the visibility when using the computer was too close so the body bends forward. Based on research conducted by Baker et al. (2018) in adults with experimental methods, it was found that sitting for a long time had a negative effect on the back muscles, so it was recommended that the angle of the back should be enlarged when sitting.

Knee Angle

Based on the Regulation of Ministry of Manpower of the Republic of Indonesia Number 5 of 2015, one of the guidelines in the design of work stations is that the knee flexion should form an angle of 90o with the soles of the feet resting on the floor or foot support (Menteri Ketenagakerjaan Republik Indonesia, 2018). The assessment results showed that most of the knee angles of the academic and student affairs department workers of the Public Health Faculty, Universitas Airlangga were not optimal at work (81.8%). Most of the VDT users did not form a knee angle of 90° in the condition of the feet flat on the floor. This means that the position of the workers leg was mostly lifted (not neutral) which can be caused by many factors, for example, the chair was difficult to adjust so the height of chair was not optimal, or the heels were too high for female workers, or the thigh was raised because of the long legs and the chair could not be lowered. Meanwhile, a neutral foot condition with a knee angle of 90^{o} can avoid musculoskeletal disorders (Mohamad and Rahman, 2018).

Legroom

The room below the table is one of the elements in constructing a convenient VDT work station in order to facilitate leg access (Tarwaka, 2015). Working in a sitting position is monotonous work, so that there is legroom to help the workforce to get rid of boredom by moving their foot. The legroom element was optimal because most of the VDT work stations in the administration room of the Public Health Faculty, Universitas Airlangga, had legroom under the table (81.8%). The condition that caused a small number of workstations to not have legroom was the number of documents placed under the table so that there was no legroom. Supposedly, documents are placed in a cupboard. However, because the cupboard was not fit, the worker was forced to put it under the table, while the legroom can be beneficial for workers in stretching muscles when working hours. This stretch can reduce musculoskeletal complaints caused by non-optimal work stations (Pradnyawati, Tunas and Natalia Yudha, 2017).

Footing

Footing is also called a foot support. The design of a work table for work that used VDT needs to consider the elements of footing because it has some benefits, among other things, it is useful for workers who are short in stature to be able to adapt to the height of the table without hang their legs when sitting, and so that the feet can move between feet floor and foot support (Suhardi, 2015). Based on observations, all of the VDT work stations in the administration room of the Public Health Faculty, Universitas Airlangga, did not have a footing, so it was considered not optimal (100.0%) because work in a sitting position requires a table that provides foot support (Suhardi, 2015). The footing is not needed if feet can rest on the floor. However, the

footing is an additional facility on the table so that the feet are not always static.

Document holder

Based on observations, all of the VDT work stations in the administration room of the Public Health Faculty, Universitas Airlangga did not have document holders, so they were considered not optimal (100.0%). In fact, the provision of document holders is very important for computer users. Document holders are useful to place documents that are often needed when working in close proximity to the monitor so that the eyes do not need to look far and the body does not need to move around (Suhardi, 2015). In addition, it can also reduce the movement of the head of VDT users when working (Restuputri, Puspita and Mubin, 2019).

CONCLUSION

Most of the elements measured were optimal, but there were some elements that had the most frequency to be not optimal in the assessment of the VDT work station in the administration room of The Public Health Faculty, Universitas Airlangga, including the elbow angle and keyboard position, chair height, knee angle, footing and document holder. The elbow angle and keyboard position, as well as the knee angle were not optimal because the chair was difficult to adjust, and the result shows that the height chair was not optimal.

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