

DESIGN OF ERGONOMIC WORK DESK FOR WORKBENCH PRACTICUM

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Abstract. Polytechnics as vocational education that applies more mastery of ability in the field of technology by prioritizing 70% practicum and 30% theory. As for workbench practicum, it is one of the basic practicum in the Automotive Engineering Department. This practicum contains basic mechanical work that is within the scope of conventional machining. The problem is the ineffectiveness in conducting the practicum process, where facilities and infrastructure are minimal and far away from the reach of work equipment, thus inhibiting the bench work practicum process. So it needs to be conducted on ergonomic workbench by determined good body position or movement based on the RULA value. The results of the application of ergonomic bench design workbench related that with setting equipment in one table, worker position, and the use of equipment had a value of RULA was 4.

Keywords : Ergonomic, Workbench, Vise, Effectivity, RULA

1. INTRODUCTION

Automotive engine is one of the study programs at State Polytechnic of Tanah Laut. Automotive engine study programs continue to strive to organize and develop vocational education that is in accordance with the competencies in the field of mechanical engineering and automotive to be able to meet the needs of industry in Tanah Laut District. as a vocational education, automotive engine study programs have a curriculum of 70% practicum and 30% theory. This aims to make students more skilled in working skills [1]

One of the practicum in the automotive engine study program curriculum is workbench practicum. Workbench practicum is a basic practicum in the field of mechanical engineering. This practicum is usually conducted in the first semester of lecture.

In various studies, there has been an influence of the application of ergonomics in the world of work, such as improving work performance due to the implementation of ergonomics in workbench practicum at 5.74% compared to not applying ergonomics, namely in the assessment of aspects of working time, flatness, sophistication, conformity fineness of workpiece [2].

Sutarna (2013), the research has used the foundation for workbench practicum by measuring the workload through the pulse of a minute to the height of the vise, the results has revealed that the use of the foundation was very effective in increasing comfort, health and safety of students in workbench practicum [3].

There are problems such as the wrong position in practice, the lack of equipment so there is a waiting time (turns) in the use of tools, and remote equipment coverage, so an ergonomic work desk design is needed to accommodate students in practicing workbench in groups without having to move places, because the workpiece and equipment will be in one table in the middle to facilitate the process of working the bench.

2. METHODS

The stages to be conducted in this study were as follows Figure 1:

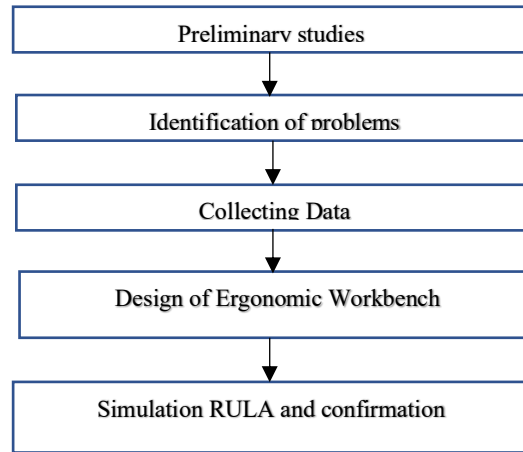


Figure 1. Flow Diagram

After conducting the work desk design then the next work desk design is conducted in accordance with the results of observations of students who did practicum and workbench practicum activities to be conducted. It concerned about the dimensions, shape, work corner of the bench, workbench material, effectiveness, and RULA (Rapid Upper Limb Assessment) [4].

The method of evaluating to person's body and muscle parts during activities measured by the level of injury risk. Such as workplace accidents, injuries, the best position and ergonomics. This is influenced by [5]:

- a. The work position is not natural
- b. Repeat work on one type of muscle
- c. Excessive use of energy
- d. Static work position
- e. Contact occurs with body parts with the environment or work equipment
- f. Method / method of work
- g. Working hours are too long

3. RESULTS AND DISCUSSION

Data retrieval was conducted in the Workshop, by measuring student body posture, along with height measurement data Table 1.

Table 1. Student Body Height Data Practicum Workbench

Initials Name of Students	Height body	Armpit height	Upper arm length	Forearm length	Wrist height
	a	b	c	d	e
IS	175	133	33	30	81
MR	171	134	31	28	81
AM	157	123	28	28	77
HD	160	123	28	25	78
AF	175	133	31	29	86
DN	170	134	31	28	85
DS	168	132	30	27	84
FZ	160	126	26	26	80
SP	163	127	27	25	78
AN	166	129	28	29	80
AR	167	120	33	27	78
FT	170	130	26	30	85
FR	174	134	30	30	84
Fikri	178	135	30	29	84
AG	166	127	28	30	80
EW	175	138	30	30	83
BA	170	134	28	26	84
FM	172	128	26	26	80
IK	166	130	28	28	84
RA	161	120	26	24	80
Mean	168.20	129.50	28.90	27.75	81.60

(source: research data, cm)

The following is a method of measurement conducted on students body posture, as in Figure 2, for example a is for height, b for armpit height and so on.

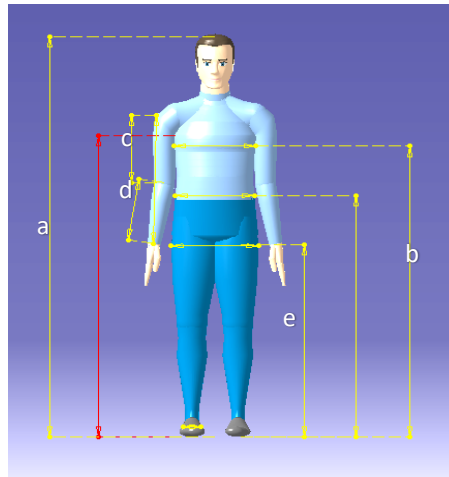


Figure 2. Methods of Student Body Posture Measurement

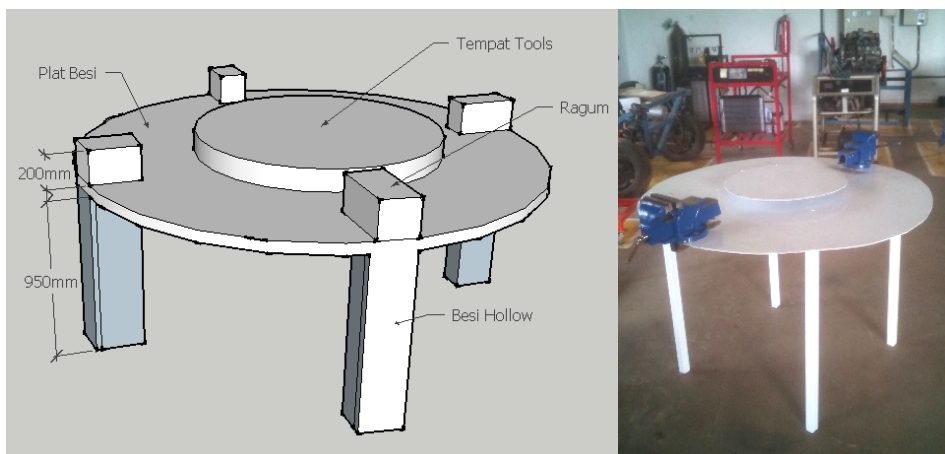


Figure 3. Design of Ergonomic Workbench

With the average height of the student doing the workbench practicum was 168.2 cm, with the upper arm length of 28.9 cm, it could be determined the height of the hollow metal as the workmanship was 95 cm, with a height of 20 cm. So the total height of the vagus was 115 cm, according to the lower arm angle of 65 degrees, from arm straightness with RULA 2 score, and max workbench capacity for 4 students.

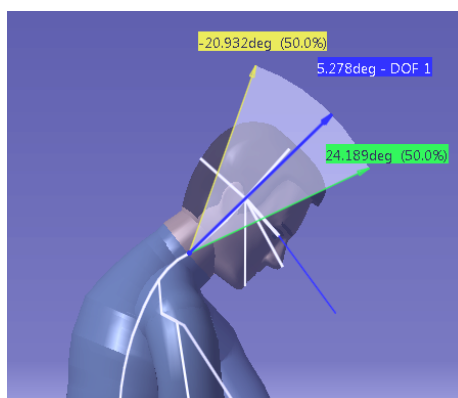
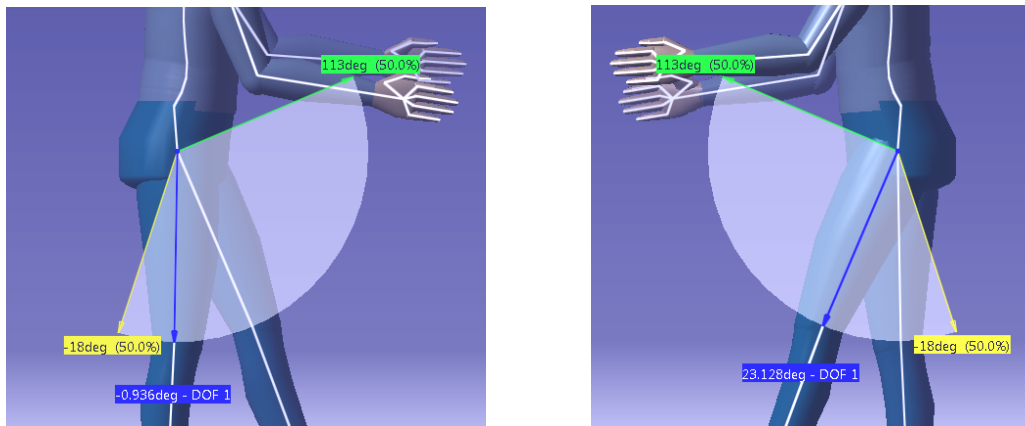


Figure 4. Neck and Head Position

In Figure 4, could be seen the angle for the head position slightly looking down at the vise and the work process in hand, getting the RULA 2 score.



(a) Right

(b) Left

Figure 5. Leg Position (a) Right; (b) Left

For the position of the foot as shown in Figure 5, in conducting the practicum, the left foot was forward for 23 degrees, and the right foot was backward by 0.9 degrees. The pedestal was charged to the left leg, because the movement of the hand muscles was on the right. It conducted in order to be strong in the process of thinking or cutting metal, the results will be maximum and accurate.

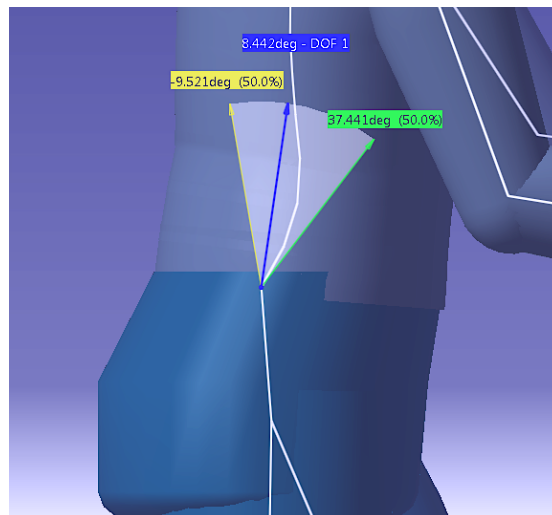


Figure 6. Wrist Position

Seen in Figure 6, the back position was slightly bent, around 6 degrees, so that the RULA score was 2.

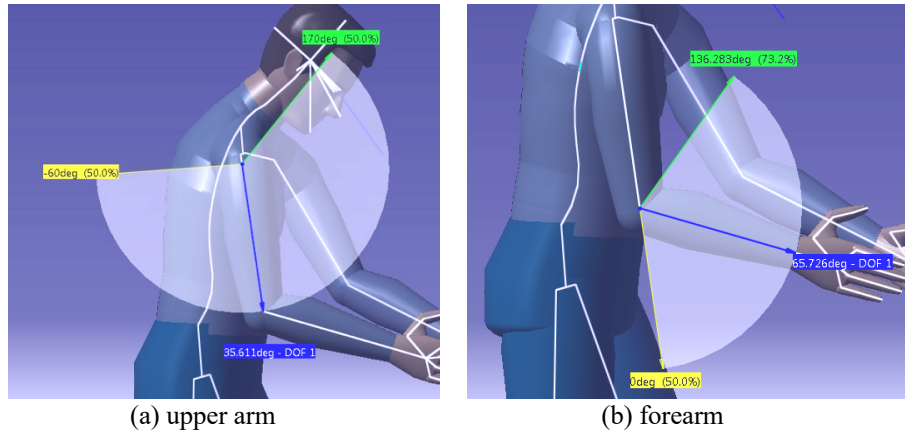


Figure 7. Position of the Right Hand (a) Upper arm ; (b) Forearm

In Figure 7, the position of the upper right arm got a RULA 2 score, and the RULA score forearm 1. This attitude was in accordance with the bent back movement, so the work wasn't too heavy and is highly recommended in the process of implementing workbench practicum.

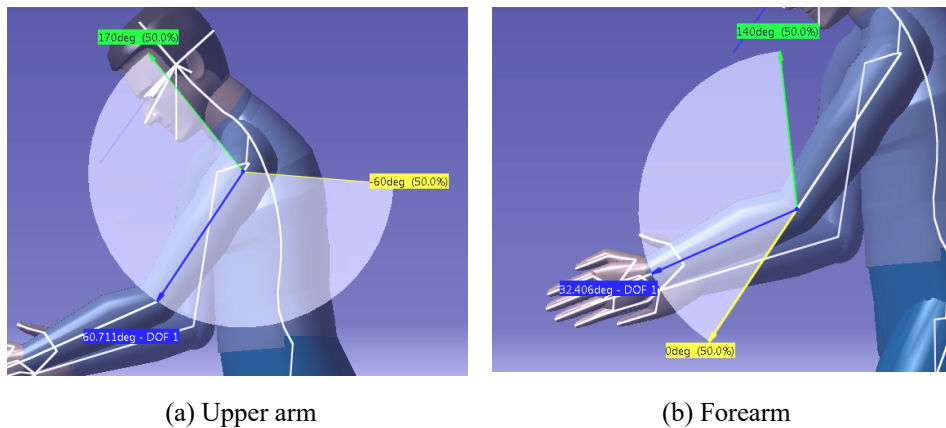


Figure 8. Position of the Left Hand (a) Upper arm ; (b) Forearm

In Figure 8, the position of the upper left arm got a RULA score of 3, and the forearm score of RULA 2. This attitude were still permitted to perform the workbench practicum process, because the position was rather straight from the upper arm to reach the corner of the equipment while holding and as a guide. so the workload is large and the angles formed were also large, with repetitive work. Seen in Table 2.

Table 2. RULA score before and after applying workbench ergonomic

RULA score	Ergonomic workbench	
	Before	After
Neck	4	1
Trunk	2	2
Wrist	2	2
Left Upper arm	3	3
Left Forearm	2	2
Right Upper arm	2	2
Right Forearm	1	1
Leg	1	1
Total Score	6	4

4. CONCLUSION

The ergonomic design of the workbench had dimensions of 115 cm, table diameter of 120 cm, and diameter of the equipment 50 cm that could be rotated, with the calculation of RULA was 4 and workbench maksimum capacity of 4 students.

5. ACKNOWLEDGEMENT

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