A BRIEF REVIEW OF ERGONOMIC WORKSTATION FOR DISABILITY STUDENT

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Abstract

This paper presents the review of the ergonomic on workstation for disable student in higher education. Most of disable especially in term of physically disable student has limitation in their study area, which highlighted here as workstation. The main objective of this paper is to discuss the significant role of ergonomic workstation for disable students, which will create an enjoyable learning environment for these students thus enhancing their self-motivation to learn. This review was conducted by referring on the published journal articles, conference papers, legislation, standards and other reports available on the internet sources. Data from the literature review shows that the number of disabled persons in Malaysia was on the rise from year 2009 till 2012 and they are facing many challenges in obtaining good education to prepare for their future work life. Many students with disabilities drop-out from high school before graduating, leaving them even more unprepared for and less likely to obtain a job. Therefore, implementation lifelong learning programs could provide them the opportunity to learn and equipped them with the appropriate skills and enhanced their survival in this challenging world.

Keywords: Ergonomics; workstation; disabled student; higher education

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Graphical abstract

Number of disabled students enrollment in Malaysia Public Higher Education Institute

\begin{tabular}{|c|c|}
\hline
Year & Number of disabled student \\
\hline
2009 & 979 \\
2010 & 1115 \\
2011 & 1221 \\
2012 & 1372 \\
\hline
\end{tabular}
1.0 INTRODUCTION

Higher education institutions in Malaysia have gone through a lot in order to improve and upgrade their reputations as the centre of successful education not only for normal persons but also for disabled persons. According to Kamaruddin [1], this tedious job has started since 1961, when lifelong learning campaign has drawn attention of the public to recognize the importance of education and it was found that the lifelong learning is not something new in adult with disabilities. It is the Malaysian’s government policy that “education for persons with disabilities should form an integral part of national educational planning, curriculum development and school organization” [2]. As stated by UNICEF, under Education for All (EFA) it is important that every child and adult received good quality basic education, based both on human right perspective and on the generally accepted belief that education is central to individual well-being and national development [3]. However, one of the biggest challenges for disabled person in gaining knowledge at higher education level is the limitation of study facility, which is highlighted here as a workstation. Therefore, this study aims to determine the significant criteria that the special workstation should be equipped and later investigate the importance of the workstation for disabled student’s performance in Higher Education Institution.

People with disabilities in Malaysia can be considered as one of the most vulnerable of the minority group in the Malaysian population [4]. According to World Health Organization (WHO), 7% of the population in any country suffers from disability and around 2% would need some form of rehabilitation services [3]. Referring to the statistics from the Department of Social Welfare [4], the registered number of disabled people in 2009 stood at 283,577 and rise to 494,074 in year 2013, which show an additional of 210,497 in just four years. Number of disabled person registered by type of disability in Malaysia is shown on Table 1.

Table 1 Registration of Person with Disabilities (PWD) by Category of Disabilities, 2009-2013 [5]

<table>
<thead>
<tr>
<th>Type Of Disability</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>283,577</td>
<td>314,247</td>
<td>359,203</td>
<td>445,006</td>
<td>494,074</td>
</tr>
<tr>
<td>Visually Impaired</td>
<td>26,158</td>
<td>27,940</td>
<td>31,924</td>
<td>40,510</td>
<td>46,307</td>
</tr>
<tr>
<td>Hearing</td>
<td>37,735</td>
<td>39,824</td>
<td>43,788</td>
<td>53,357</td>
<td>58,706</td>
</tr>
<tr>
<td>Physical</td>
<td>94,346</td>
<td>105,020</td>
<td>123,346</td>
<td>148,461</td>
<td>162,215</td>
</tr>
<tr>
<td>Learning Disability</td>
<td>109,743</td>
<td>102,109</td>
<td>134,669</td>
<td>165,281</td>
<td>178,800</td>
</tr>
<tr>
<td>Speech</td>
<td>-</td>
<td>334</td>
<td>725</td>
<td>1,734</td>
<td>3,677</td>
</tr>
<tr>
<td>Mental</td>
<td>-</td>
<td>3,663</td>
<td>8,927</td>
<td>14,990</td>
<td>19,914</td>
</tr>
<tr>
<td>Others</td>
<td>11,524</td>
<td>13,369</td>
<td>15,834</td>
<td>20,673</td>
<td>24,455</td>
</tr>
</tbody>
</table>

As stated by UNICEF, under Education for All (EFA) it is important that every child and adult received good quality basic education, based both on human right perspective and on the generally accepted belief that education is central to individual well-being and national development [3]. However, one of the biggest challenges for disabled person in gaining knowledge at higher education level is the limitation of study facility, which is highlighted here as a workstation. Therefore, this study aims to determine the significant criteria that the special workstation should be equipped and later investigate the importance of the workstation for disabled student’s performance in Higher Education Institution.

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2.0 IMPORTANCE OF ERGONOMIC

It has long been understood that ergonomics offers numerous benefits, but recently a stronger emphasis has been placed on the importance of ergonomics in the workstation design. The subject of ergonomics in the workstation has become very important. In this era of globalization, education is one of the most important things that help one person to survive. Not only for normal person but also important to disable person. The disabled person need to break the misconception that they are dependent and helpless instead, they need to be recognized as independent and should instead be treated as equal citizens requiring special accommodation. So, by giving them a special place in education can make them feel they are needed in the community.

Ergonomics seeks to prevent such injuries by studying the relationship between the workstation and people in order to improve comfort and overall efficiency while on the job. Due to the fact that almost 70% of all work performed in the country today is done while at a seated station, many ergonomic considerations apply to work that is performed while sitting at a computer [8]. For example, adjusting the chair height so that feet are able to rest flat on the floor and the knees can be flexed at a ninety degree angle, which can help to provide proper lumbar support and prevent strain [9].

3.0 ERGONOMIC WORKSTATION FOR DISABLED STUDENTS IN HIGHER EDUCATION

Workstation for students with disabilities required special design to suit their need, especially for those with restricted mobility. In most cases, student with physical disabilities especially the one that required the used of wheelchair will face the big challenge in the learning environment. The study from Department of Industrial Engineering and Management, Chaoyang University of Technology indicates that currently available commercial workstation present difficulties in terms of both spatial design and reachability of peripheral devices to wheelchair users [10,11]. Ergonomics issues for the physically challenged individuals, e.g., the wheelchair users, have been studied, as most developed countries have anthropometric measurements for wheelchair users [12]. However, the interaction between wheelchair users and specific workstations has not often been considered and studied [13].

Some issues have been highlighted by Jarosz [14], because there is a mismatch between the workstation provided for able-bodied population and mobility aids population; especially for wheelchair user [14]. The mismatches are attributed to different anthropometric characteristics of wheelchair user compared to able-bodied population [15] and smaller reach capability of wheelchair users compared to normal population [14].

In the meantime, different anthropometric dimension measured in wheelchair user is attributed to large differences in terms of types of disabilities [16] and different types of wheelchair which is manual and powered propelled wheelchair with different design of accessories like footrest and armrest [10,17].

4.0 DESIGN OF WORKSTATION

One of the most important factors that related to work-related musculoskeletal disorders (MSDs) is the design of workstation (excluding technique of individual working, body posture and muscular loads) [18]. According to Helander & Lin [19], ergonomic design is use to ensure it is within user’s capability and limitations while handling machineries, products and workstation. The knowledge focused on the relationship of the designed objects and environment with reference to human factors [20].

In human-workstation interaction, it is important that the workstation is designed to adjust the task and fit to the purpose [21]. Lee from Department of Industrial Engineering and Management, Chaoyang University of Technology [22] has done a simulation on computer desk workstations to determine whether they are appropriate for use by wheelchair users. The study focuses on how wheelchair users perform their daily work. According to Lee [22], the adequacy, as well as the advantages and disadvantages of currently available workstations, are investigated with...
computer simulation. There is no specifically study on the workstation for student with mobility difficulties. However, the concept is still same with computer desk worker due to the characteristic of the work and the position that suit the wheelchair user.

The simulation was done by using commercial computer desk workstation and the dimensions list shown in Table 2. Figure 2 shows that the observations of their daily activities yielded similar conclusions from the postures viewpoint, suggesting that the use of simulation technique may be a valid tool for evaluating proposed workstation designs. Figure 3 shows simulation examples on reach enveloped for wheelchair user [22].

### Table 2 Major Dimension of Three Commercial Desks Studied (in mm) [22]

<table>
<thead>
<tr>
<th></th>
<th>WS I</th>
<th>WS II</th>
<th>WS III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total height</td>
<td>1175</td>
<td>1300</td>
<td>1600</td>
</tr>
<tr>
<td>Total breadth</td>
<td>1080</td>
<td>800</td>
<td>660</td>
</tr>
<tr>
<td>Total depth</td>
<td>600</td>
<td>600</td>
<td>450</td>
</tr>
<tr>
<td>Desk height</td>
<td>740</td>
<td>800</td>
<td>745</td>
</tr>
<tr>
<td>Surface height for keyboard</td>
<td>640</td>
<td>680</td>
<td>670</td>
</tr>
<tr>
<td>Surface height for monitor</td>
<td>680</td>
<td>800</td>
<td>720</td>
</tr>
</tbody>
</table>

(WS: Workstation)

### Figure 2 Comparison of simulation system and laboratory setup for wheelchair users [22]
- (a) and (b) reach of printer
- (c) and (d) turning the CPU system unit on and off

### Figure 3 Simulation examples on reach enveloped for wheelchair user [22]
- (a) Female in WS I (easy to access desk);
- (b) Male in WS I (hitting the keyboard tray);
- (c) Female in WS II (hard to operate the printer);
- (d) Male in WS II (reachable to the printer);
- (e) and (f) the reach envelope of female and male subjects with normal upright posture in WS III, respectively.

### 5.0 SIGNIFICANCE OF ERGONOMIC WORKSTATION FOR DISABLED STUDENT

Ergonomic workstation plays important roles as it helps facilitate the disabled students in completing their works especially the wheelchair users. As a matter of fact, the concern about the problems faced by this distinct group had initiated the acceptance of normalization services in Malaysia. In Europe, normalization principle has been adopted in the guidelines for providing education and services for people with disabilities [23]. They faced difficulties to move from one place to another, especially the one that required them to climb.

For example, observation in University of Sultan Zainal Abidin in Terengganu, Malaysia, shows that most of the computer laboratories are located on the second floor and the elevator to access the floor is only available at certain buildings. When the task required them to use the computer such as making 3D models, they have to climb up to second floor. In the meantime, the laboratory table offers limited reach
enveloped for the wheelchair user. As the result, completing the task will be hard, and it will definitely demotivate them thus will lead to a decline in their performance as well.

6.0 CONCLUSION

The implementation of Lifelong Learning programs and normalization principles in Malaysia bears a great influence on the education for people with disabilities. No doubt about the challenges faced by the disable person is much bigger than what a normal person faced but it can be seen unfair if just the normal person get most of the advantages, including education.

Many students with disabilities as well as those with chronic achievement problems drop out of high school before graduating, leaving them even more unprepared for and less likely to obtain a job. Most students with disabilities can easily become demotivated and feeling down. High schools can better engage and support these students by helping to identify their strengths, interests and providing them with the appropriate skills (or a plan for gaining them) they need to succeed in their future endeavour. Ergonomics has already been defined to fit the task to the person and its primary focus is on the design of work activity that suits the person, which takes into account their capabilities and limitations.

Acknowledgement

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References