

## A BRIEF REVIEW OF ERGONOMIC WORKSTATION FOR DISABILITY STUDENT

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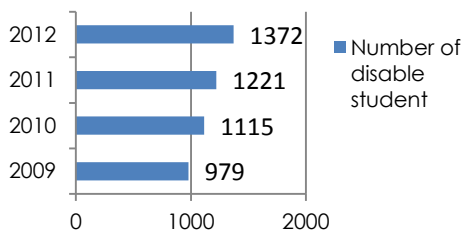
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### Graphical abstract

Number of disabled students enrollment in Malaysia Public Higher Education Institute



### 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

### Abstrak

Kertas kerja ini membentangkan kajian semula ergonomik pada stesen kerja untuk pelajar kurang upaya dalam pendidikan tinggi. Kebanyakan pelajar kurang upaya terutamanya dari segi fizikal berdepan kekangan di kawasan pembelajaran mereka, dimana ditekankan di sini sebagai stesen kerja. Objektif utama kertas kerja ini ialah untuk cuba membincangkan kepentingan stesen kerja ergonomik untuk pelajar kurang upaya yang boleh mewujudkan persekitaran yang lebih mengembirakan untuk pelajar-pelajar ini dan seterusnya meningkatkan motivasi mereka untuk belajar. Kajian dijalankan dengan merujuk kepada artikel jurnal, kertas persidangan, perundangan, standard, dan lain-lain laporan yang terdapat daripada sumber internet. Data daripada sorotan literatur menunjukkan bilangan orang yang kurang upaya di Malaysia meningkat daripada tahun 2009 hingga 2012 dan mereka menghadapi banyak cabaran untuk mendapatkan pendidikan yang baik bagi menyiapkan diri mereka untuk menghadapi dunia kehidupan bekerja dimasa depan. Ramai pelajar kurang upaya berhenti sekolah sebelum menamatkan pengajian mereka, ini menyebabkan mereka tidak bersedia untuk diterima bekerja. Oleh itu, pelaksanaan pembelajaran sepanjang hayat dapat memberi mereka peluang untuk belajar dan melengkapkan mereka dengan kemahiran yang sesuai dan meningkatkan survival mereka di dunia yang penuh cabaran ini.

Kata kunci: Ergonomik; ruang belajar ; pelajar kurang upaya; pengajian tinggi

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## 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 challenge for disable 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.

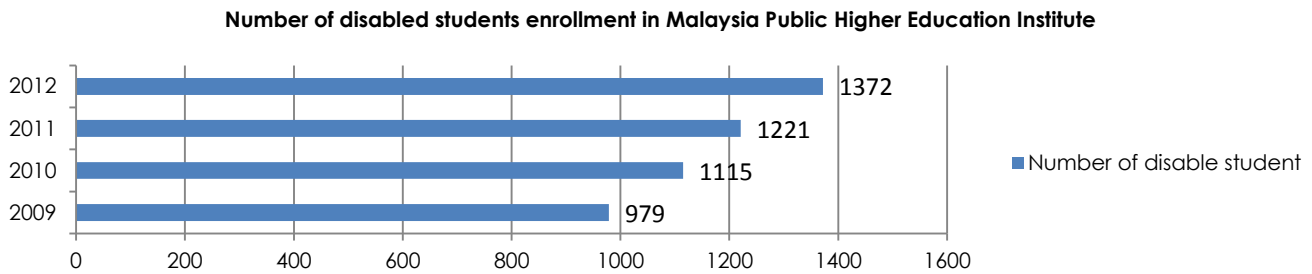
Although physical ability restricted the person's mobility, it is not an obstacle to pursue their study at higher level. According to Ministry of Higher Education Malaysia (MoHE) [5], the number of students with

disabilities enrolled in Public Higher Education Institute (HEI) in Malaysia has increase since 2009 till 2012. Latest statistic (Figure 1) shows there is 1,372 disabled students enrolled in HEI in 2012, the highest number was recorded in Universiti Teknologi Mara (UiTM) [5].

Basically, the term ergonomics can be defined simply as the study of work. Scientifically, ergonomics is the science of designing the job to fit the worker, rather than physically forcing the worker's body to fit the job [6]. This is achieved through the evaluation and design of workstation, environments, job tasks, equipment, and processes in relationship to human capabilities and interactions in the workstation. For example, anytime there is a change in the workstation (new employee, new chair, and new desk), new ergonomic solutions are required [7]. The same thing happen in study environment which is also involves the same requirement of workstation for each student. It is important that all furniture (chairs, desks) and other accessories are adjustable in order to meet individual needs, as no two people are alike. In fact, even there wouldn't be any problem for normal student but in disabled student's perspective, a special study area is needed to overcome his limitation in certain area which it's not freely accessible without asking for help. According to the Workplace Ergonomics Reference Guide [7], the terms of ergonomics covers the entire work area, including issues regarding the chair, workstation, and lighting. Effective use of ergonomic practices will assist in maintaining high levels of productivity, avoiding pain and injuries, and most important increasing workers' satisfaction [7]. In learning situation, adapting tasks, workstations, tools, and equipment to fit the student can help reduce physical stress on the body. According to Occupational Safety and Health Administration (OSHA) [6], ergonomics draws on a number of scientific disciplines, including physiology, biomechanics, psychology, anthropometry, industrial hygiene, and kinesiology. The main objective of this paper is to discuss the significant role of ergonomic workstation for disable students, which unquestionably will create an enjoyable learning environment for these student thus enhancing their self-motivation to learn.

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

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



**Figure 1** Number of disabled student enrolment in Malaysia Public Higher Education Institute [5]

## 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 people but also important for disabled people. The disabled person needs to break the perception 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 requires special design to suit their needs, especially for those with restricted mobility. In most cases, students with physical disabilities, especially those who require the use of a wheelchair, will face a big challenge in the learning environment. The study from the Department of Industrial Engineering and Management, Chaoyang University of Technology indicates that currently available commercial workstations present difficulties in terms of both spatial design and reachability of peripheral devices to wheelchair users [10,11]. Ergonomics issues for 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 the able-bodied population and mobility aids population; especially for wheelchair users [14]. The mismatches are attributed to different anthropometric characteristics of wheelchair users compared to the able-bodied population [15] and smaller reach capability of wheelchair users compared to the normal population [14].

In the meantime, different anthropometric dimensions measured in wheelchair users are 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 designs of accessories like footrest and armrest [10,17].

## 4.0 DESIGN OF WORKSTATION

One of the most important factors 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 used to ensure it is within user's capability and limitations while handling machinery, 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 the 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

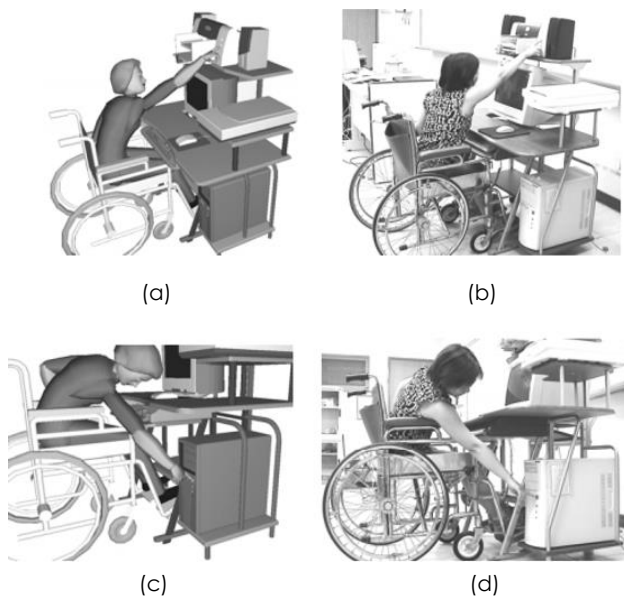
computer simulation. There is no specifically study on the workstation for student with mobility difficulties. However, the concept is still same with computer desk worker due to the characteristic of the work and the position that suit the wheelchair user.

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]

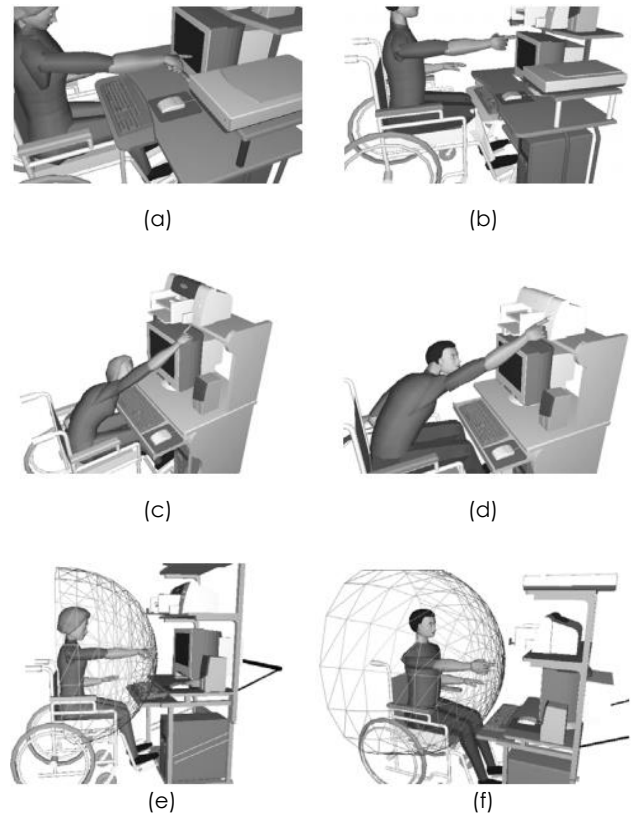
	WS I	WS II	WS III
Total height	1175	1300	1600
Total breadth	1080	800	660
Total depth	600	600	450
Desk height	740	800	745
Surface height for keyboard	640	680	670
Surface height for monitor	680	800	720

(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.

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