

DESIGN OF A WORKSTATION

LAB REPORT 1

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*Excellent
description of work
station and human
factors*

1. Introduction

Ergonomics refers to the design of the working place to allow objectives to be achieved comfortably and easily. This laboratory focuses on principles of anthropometry, or the measurements and the application of data to design things for efficient and comfortable use. Specifically, the physical design of a study work space was undertaken for use by quadriplegics, confined to wheelchairs. The object is to facilitate their efficiency at the workplace by designing the facilities to meet their special requirements and comfort.

2. Characteristics of a Work Station

A work station is a study area suitable for wheelchair access which provides ample non-glare lighting and a non-reflecting desk surface for reading and writing, as well as a storage area for notes and books. Because wheelchairs are being used, no seating was provided. However, extra height and foot room is required so that wheelchairs may be pushed under the bench. Facilities should be available for accessible electric outlets for tape recorders. The users are ten quadriplegics, resident in the quadriplegic centre.

3. User Characteristics

The users are all adult quadriplegics, of both sexes confined to manual push wheelchairs who are engaged in further study. As a result of spinal injury, none have normal use of their fingers. Frequently both hands must be used to grasp heavier objects such as books. Most lack use of triceps and are unable to lift their arms vertically above their heads. All the subjects lack control of their abdominal muscles and cannot lean forward without securing one arm to the back of their chair.

Initially, static and dynamic measurements for wheelchair users have been taken from Humanscale Wheelchair Users. Measurements of the work station, however, would be based on the largest adult and wheelchair in the group of ten. The small population made traditional design within the 5th and 95th percentiles (Sanders & McCormick, 1987) unfeasible since access was important for the entire population

of ten users. Maximum clearance for legs below the table and for feet from the wall were essential. Shelves were placed within easy reach of the work space envelope so that quadriplegics could tumble books on to the table without grasping. The work bench was sufficiently narrow to allow all shelving to be reached easily. The bench was angled upward so that printed materials were held at an angle which was more visible and legible for readers, without leaning forward or holding the papers. An anti-slip rail was placed along the lower edge to keep materials from sliding off the desk onto the floor.

Adjustability of the table for height was considered essential. This was accomplished simply and cheaply by cutting a number of wooden blocks of 1, 3, 5 and 7 cm width which could be placed under the legs to lift the table to meet unusual height requirements. However, design was such that no adjustments were needed for the ten users. The wheelchair possessed sufficient room to swing 90 degrees to allow the side bench to be used for additional work space and storage. A survey was used to determine colour.

4. Design of Alternative Workstations

The workstation is to be located in a large common room. Two formats initially considered are shown in Figures A and B.

Figure A: Square Study Station with Drawers

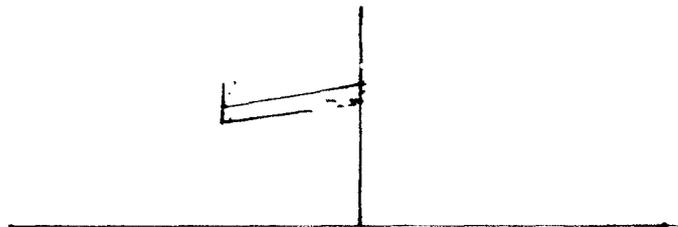
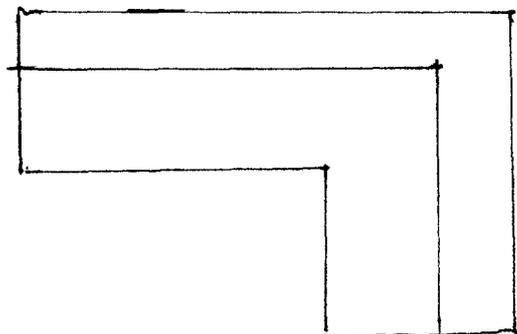


Figure B: L Shaped Work Station



5. Criteria for Selection of a Design

The design which maximised working and shelving area was judged to be superior. A corner location was judged to provide the support of two walls for shelving and the relative segregation of the user from other residents and distractions in the room. However, the work area and shelving should be built about a half meter from the wall to permit additional foot room for the users.

The single table was found too limited in terms of readily accessible shelving space and work space for two or three open books. Drawers were found to be too difficult to open and quadriplegics found difficulty in lifting objects out of them. Consequently an L shaped corner design was judged more suitable in allowing the user simply to swing the wheelchair sideways to double his workspace. An angled surface was preferred because a slanted surface was believed to be likely to increase the legibility of work materials. An historical survey of school desk design noted the popularity of slanted school desks until the 1930's as a technique for increasing readability of materials. However, this necessitated a rail to prevent papers from sliding to the floor where they could not be retrieved.

6. Measurements for the Work Station

An adjustable fluorescent drafting light which could be angled into any position was chosen as the lighting source. The electrical outlet was placed mid-way between the work surface and shelf to permit easy access. The edge of the desk was rounded to protect arms from abrasion. Shelves were placed at the chin height of the shortest user. The height of the work area was equivalent to the elbow height of the users when seated in their chairs. The work surface was five cm higher at the rear than at the front. A one cm rail was placed along the lower work edge. When wheeled to the table, two thirds of extended arm length determined the depth of the work area, based on the consideration that both hands must be used to manipulate objects. Actual measurements are shown in Figure C below.

Figure C: Measurements of the Work Station

Insert Figure C Here

7. Evaluation of the Design

Observation of the users would occur following a trial week of use to permit adaptation. The designer would determine the ease with which books could be reached, and the amount of clearance for legs and feet. Secondly, an interview could be used to discover problems.

8. Costing Alternatives

A table built to the right height was believed to be equally costly, while lacking the ease of use inherent in the work station. If two benches were already available in the residential institution, they might be mounted on blocks to provide a less desirable but cost free alternative.

Cross-Sectional View Large Male Work Area

