

Ergonomic Issues in Academic Libraries in Kolkata, West Bengal: A Pilot Study

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Introduction

In a highly competitive academic environment, the library is an essential component of an institution's intellectual expression. Libraries must design their spaces in a way that meet the needs of 21st century learning, teaching, and research. Ergonomics is an important aspect of design. Ergonomics is a scientific discipline concerned with improving productivity, health, safety, and comfort, and helping people and technology work together. Ergonomic design should support humans in achieving operational objectives. There are three goals in human-centered design.

1. Enhance human abilities
2. Overcome human limitations
3. Foster user acceptance

To achieve these objectives, there are key elements of ergonomics to consider:

1. Workstation design: chairs, work surfaces, and accessories
2. Environment: space planning, use of colors, lighting, acoustics, air quality, thermal factors, etc.

The discussion of library ergonomics and modern design technologies has been largely restricted to libraries of developed western nations. The "relevant literature" at the end of this article lists important studies and resources. There has been almost no attempt to improve libraries in India, and the issue has been largely ignored in academic libraries in West Bengal. Most of the academic institutions in West

Bengal are going through a critical phase because of rapidly-increasing enrollments, and consequently the libraries are also having problems with collection and study space.

Shelf space is crucial in library collection planning. Academic libraries that need additional space generally do not have open land to expand their storage. Many libraries have solved this problem by using compact shelving. Studies in libraries in the western nations show that up to 50 percent of the floor area can be saved by using compact shelving, because there is one access aisle for a number of ranges.

Illumination is also an important issue. There are specifications for illumination of reading areas, staff work areas, and shelves. Unfortunately, the illumination is very poor in most of the academic libraries in West Bengal. Reading or working under insufficient light for considerable time causes eyestrain that may ultimately lead to eye disorders.

Temperature and relative humidity are crucial factors in the preservation of library collections. Heat accelerates deterioration and humidity helps promote harmful chemical reactions. Heat and humidity encourage mold growth and insect activity. Low humidity can also be a problem, and cause materials to become brittle.

Noise level is another important factor that affects work in the library. Noise has a psychological effect and creates concentration problems in studying or work. Even when the library interior is quiet, there may be sound from outside that creates a problem.

Fire can be devastating to libraries. Proper fire safety is essential for any academic library.

The present study assesses the library shelving, collection arrangement (including room for growth), and makes a preliminary observation of environmental conditions (illumination, noise, temperature, humidity) and fire safety. The study also assesses user satisfaction with library services and resources.

Methodology

- The study was conducted in nine departmental libraries of an academic institution of Calcutta, West Bengal, India.
- Shelving and storage space were measured with steel tape.
- The dry-bulb (DB) and natural wet bulb (NWB) were measured using a “whirling psychrometer” or Sling’s psychrometer that houses both dry and wet bulb thermometers in wooden grooves. A handle is attached at one end, around which the psychrometer can be rotated. (60 rotations per minute are needed.) The relative humidity was calculated from the standard hygrometric table.
- The illumination level at different locations in the libraries was measured using a Lux meter [LX-101, Lutron, Taiwan].
- The noise level was measured using a Sound Level Meter [SL-4001, Lutron, Taiwan].
- Responses of library users were collected using a modified user response checklist.
- Fire-safety arrangements were assessed with a modified fire-safety checklist.

Results and Discussion

The following table shows that the existing shelving in the selected libraries occupies more than 50 percent of the total library space, reducing the reading and other functional spaces of the libraries. Not only that, further growth will put a great burden on these libraries, since the space cannot be extended further. To solve this acute space problem and to maximize the library storage capacity, use of compact or mobile shelves is strongly recommended to these libraries. The calculation of the data shows that if the

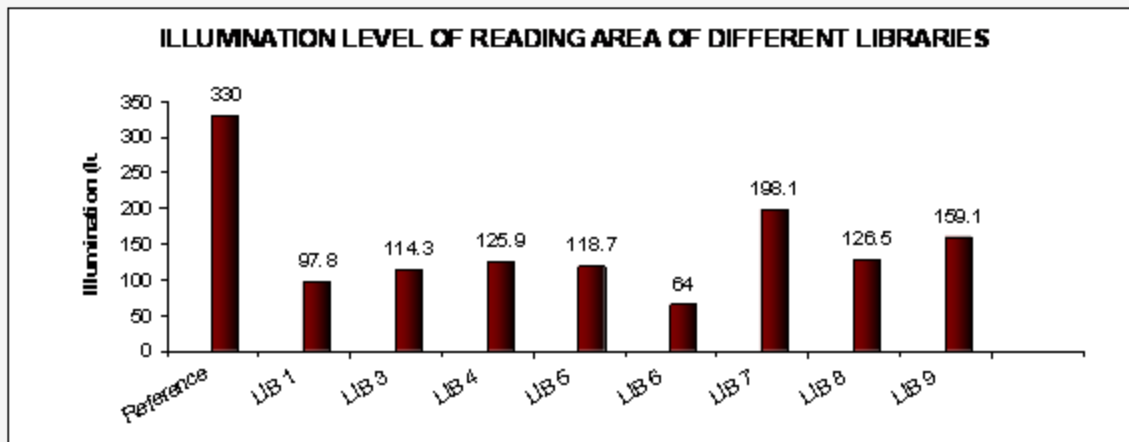
libraries use compact or mobile shelves, up to 60 percent of space can be saved for future use. The calculation is based on the following dimensions for compact shelves.

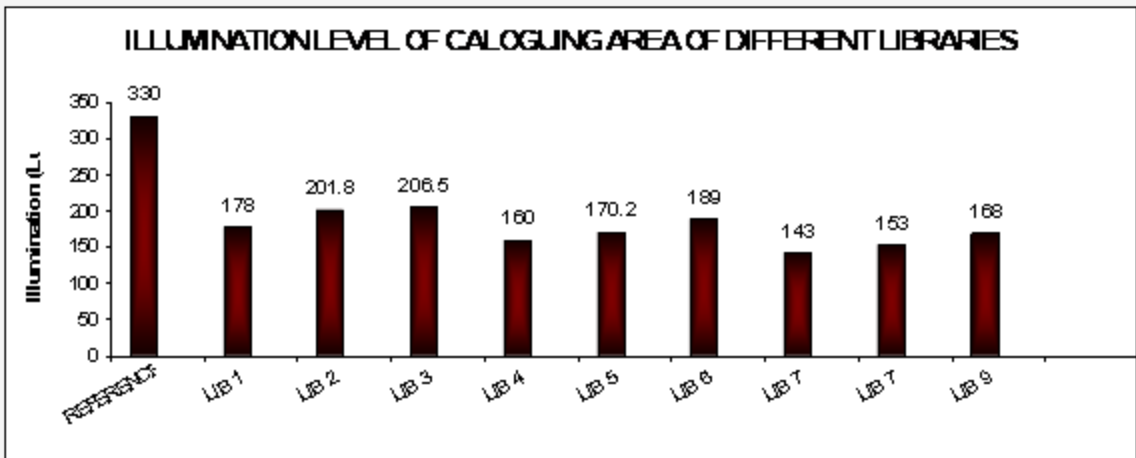
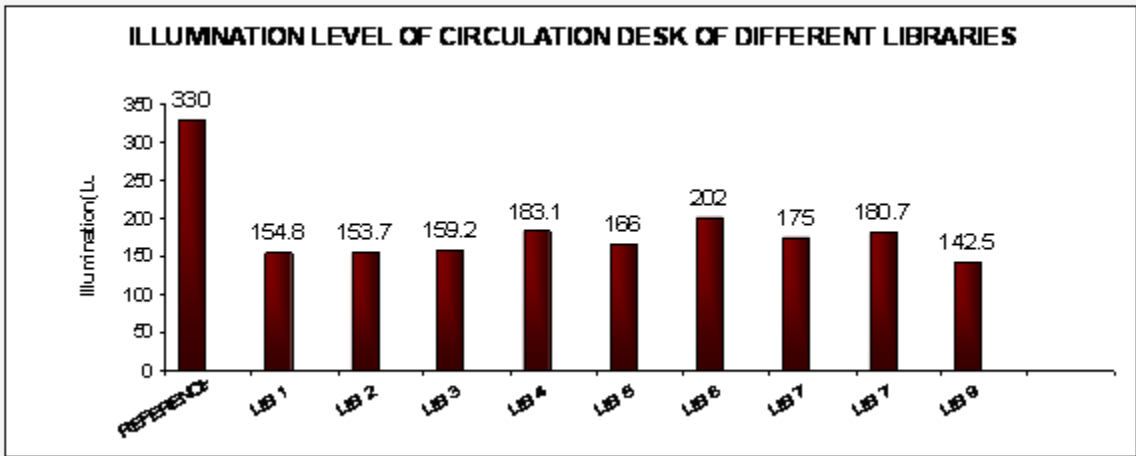
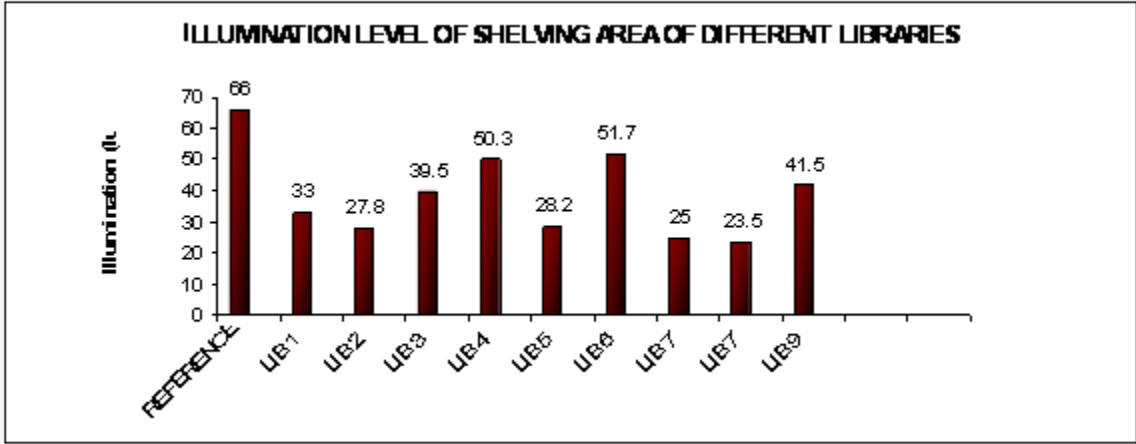
- Length: 91.44 cm
- Breadth: 53.34 cm
- Height: 213.36cm
- Aisle space= 9754.82 cm²

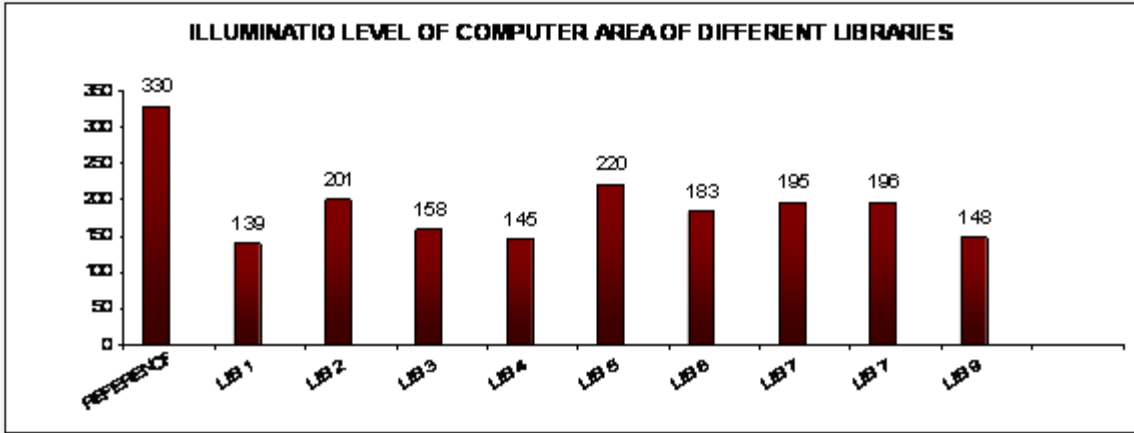
Floor Area and Shelving Data

Parameters	Lib1	Lib2	Lib3	Lib4	Lib5	Lib6	Lib7	Lib8	Lib9
Library area (cm ²)	364320	607500	534600	724500	724500	848700	422685	465300	768400
Present shelving area (cm ²)	216600	437400	387596	421080	392760	641700	282750	245700	387440
% of NAA used by shelving	59.5	72	72.5	58.12	60.2	75.61	66.89	52.80	50.42
Present shelving volume (cm ³)	18786204	19051200	23286336	18893400	26344320	17655300	15976440	15864540	25876400
No. of compact shelves required	18	18	22	18	25	17	15	15	25
Aisles needed	4	4	4	4	5	4	3	3	5
Required compact shelving area (cm ²)	126812.66	126812.66	146322.3	126812.66	170709.35	112180.43	102425.61	102425.61	170709.35
Space saved	89787.34	310587.34	241273.7	294267.34	222050.65	17543119.57	180324.39	143274.39	216730.65
% of NAA used by compact shelving	34.8	20.87	27.37	17.5	23.56	13.33	24.23	22	22.21
% of shelving space saved	41.51	71.01	62.25	69.89	60.86	82.41	63.78	58.33	55.95

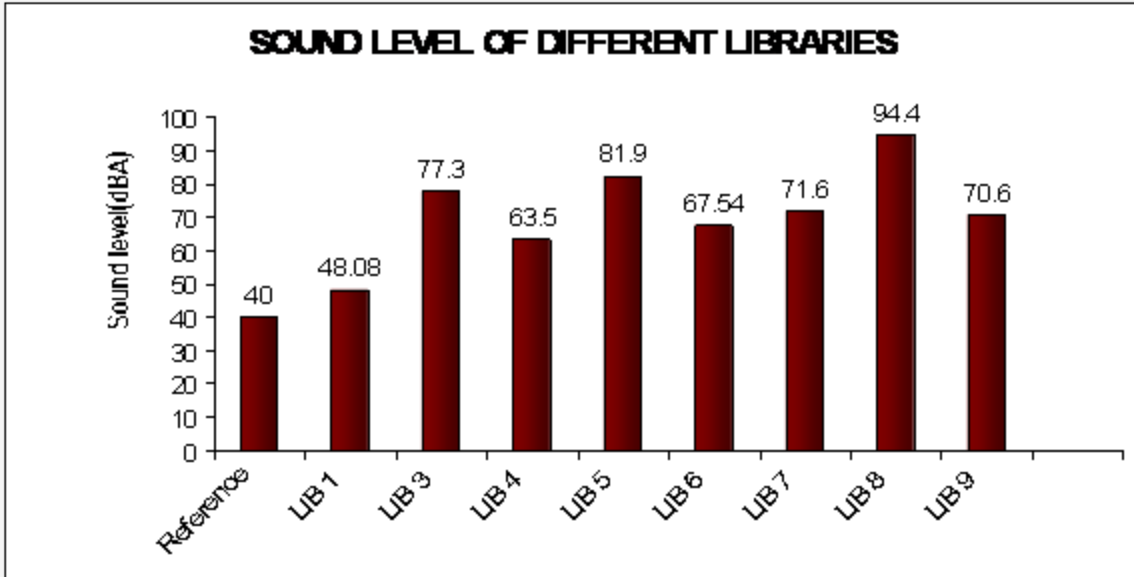
The figures below show the actual and recommended illumination levels. The lighting levels are very poor overall.



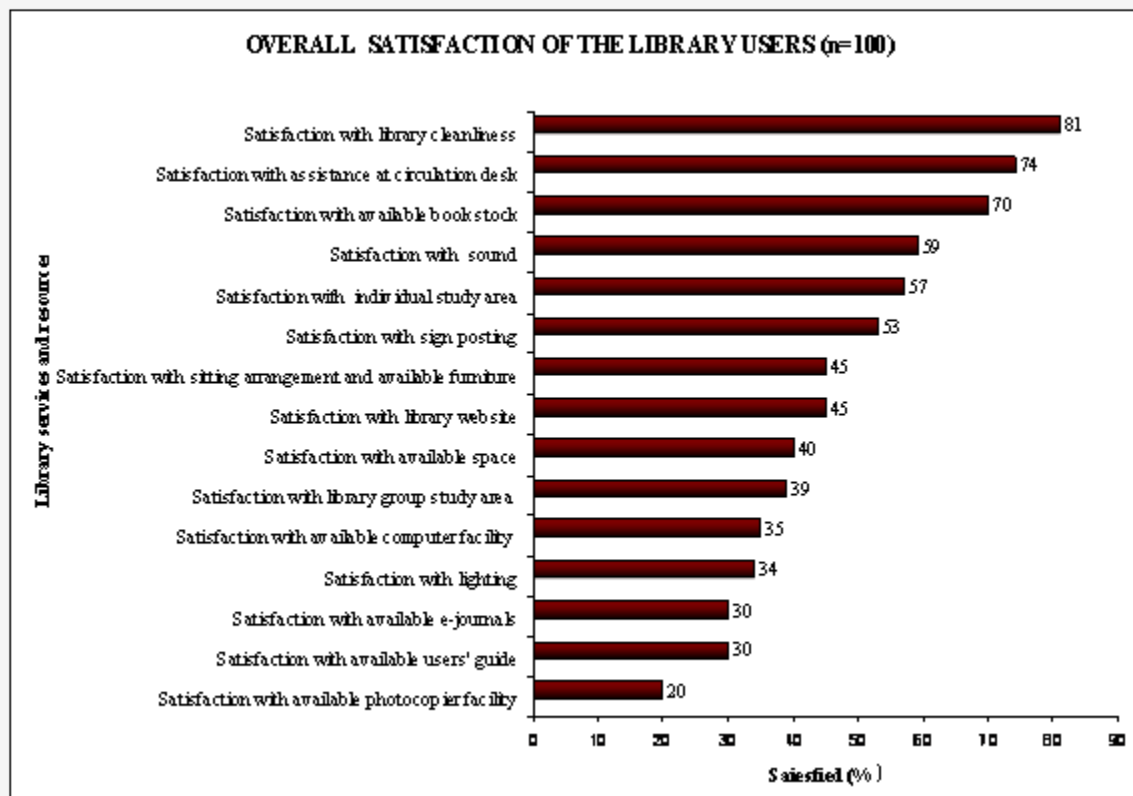




The figure below shows peak noise levels compared to recommended levels.



The following figure shows overall satisfaction of library users. Data was gathered from a small sample of students in each library. The results shows that the users are not satisfied with existing facilities and services, although there is satisfaction with staff support, collections, and library cleanliness.



The following table shows mean temperature and relative humidity values. The libraries are in the same academic building, and climatic data was collected at the same time. The results are expressed as mean and standard deviation. The data shows that temperature and humidity levels are not suitable for preservation and maintenance of books. These adverse climatic conditions may lead to destruction of new books and certain rare collections which are irreplaceable.

Table for Temperature and Relative Humidity of Different Libraries

Parameters	Mean ± SD	Range	Recommended
Temperature (0 C)	32.7 ± 0.93	31.5-34.4	16-21**
Relative Humidity (%)	48.36 ± 2.84	46-52	40-60**

The following table reveals that fire-safety arrangements are very poor in these libraries. Not a single library is well-equipped with fire safety devices. Moreover, those libraries with fire-extinguishers do not regularly check to see whether they are working.

Fire Safety

Fire safety was analyzed using a modified fire safety checklist.

Questions	Yes	No
Is there a fire extinguisher in the library?	3	6
Is there a fire alarm in the library?	0	9
Is there a functional emergency exit?	0	9

Conclusion and Recommendations

The academic libraries in the survey do not meet modern ergonomic standards. This is a pilot study with small sample numbers, and the findings are not enough to generalize about the condition of all academic libraries. Keeping in view the present findings, however, the following recommendations are made.

- Compact shelving can save space and provide room for expansion. Moreover, compact shelving is installed according to ergonomic standards, which normal fixed shelves often do not follow. Compact shelving would be physically less stressful for users. With the space saved by compact shelving usage, the amount of reading and other areas can be increased.
- The amount of light should be increased in every area.
- Light can be brought down to lower levels over the reading desks to increase illumination
- Noise can be absorbed by installing curtains on windows, and using sound absorbing wallpaper and carpets
- Suitable temperature and relative humidity may be achieved by installing more fans. Pedestal fans increase ventilation at floor level and thus decrease humidity. Air conditioners should be provided if possible
- To protect the library from danger and losses from fire each library should provide fire extinguishers in each library and train staff to use them.
- Each library should have an emergency exit door whose passage is free from furniture or other fixtures.

Relevant Literature on Ergonomics and Design

Barclay, O. (2004). Collection preservation in library building design. Available: <http://www.librisdesign.org/docs/CollectionPreservation.pdf>.

Books for Libraries (2009). Background and credentials. Available: <http://www.booksforlibraries.com/compact.asp>

Central Business Group (n.d.). Space saving solutions. Available: http://www.centralbusinessgroup.com/space_save.htm

Chandra, A.M., Ghosh, G.N., Barman S., & Sadhu, N. (2006). Effect of thermal load on work efficiency of female university students. *Indian Journal of Physiology and Allied Sciences* 60 (2):50-7.

Dean, E.T. (2005). Daylighting design in libraries. Available: <http://www.librisdesign.org/docs/DaylightDesignLibs.pdf>

Graham, K., & Grodzinski, A. (2001). Defining the remote library user: An online survey. *portal: Libraries and the Academy* 1 : 289.

Health and Safety Executive (2005). Noise at work: Guidance for employers on the control of noise at work. Available: <http://www.hse.gov.uk/pubns/indg362.pdf>

Mundt, S. (2003). Benchmarking user satisfaction in academic libraries: A case study. *LIR* 27 :29.

National Fire Protection Association (NFPA). (2002). *Inspection checklist* . Available: <http://www.nfpa.org/assets/files/PDF/inspectionchecklist.pdf>

North Carolina State University. Environmental Health and Safety (n.d.). Ergonomic workstation guidelines. Available: <http://www.ncsu.edu/ehs/www99/right/handsMan/office/ergonomic.html#introduction>

Ogden, S. (2007). The environment, temperature, relative humidity, light, and air quality: Basic guidelines for preservation. Northeast Document Conservation Center. Available: http://www.nedcc.org/resources/leaflets/2The_Environment/01BasicGuidelines.php

Siems, E., & Demmers, L. (2003). Library stacks and shelving, Libris design project. Available: <http://www.librisdesign.org/docs/ShelvingforLibraries.pdf> .

The Association for Librarian and Information Managers (2000). The primary school library guidelines. Available: http://www.la-hq.org.uk/directory/prof_issues/primary.pdf

Whole Building Design Guide (WBDG). (n.d.). Academic Library. Available: http://www.wbdg.org/design/academic_library.php