

# Ergonomic mismatch between university student anthropometry and classroom furniture in Tanzania

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## SUMMARY

The standard and guidelines of school furniture dimensions have been developed in many countries, but it's never been explored for university students in Tanzania. This study evaluated the potential mismatch between classroom furniture dimensions and anthropometric characteristics of 289 Zanzibar university students (167 females, 122 males) aged 17- 27 years. The results indicated high rates of mismatches between the body dimensions of the students and the existing classroom furniture, with seat height (100%), desktop height (93.08%), and seat width (81.40%) being the furniture dimensions with higher level of mismatch and backrest height with a lower level of mismatch (66.26%). The findings suggest that the least developed countries should improve school furniture design based on anthropometric results to avoid or minimize student discomfort and MSD problems.

## KEYWORDS

University furniture, Anthropometry, Mismatch, Sitting comfort and safety

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## Introduction

The university classrooms are similar to other work environments because there is an interplay of both “static work” and “force”. The use of poorly designed furniture, e.g., school chairs and desks that fail to match the anthropometric data of its users, has a negative impact on their health (Hafezi et al., 2010). As Oyewole et al. (2010) noted, fixed-type furniture to accommodate all users in the seat, arms, and backrests was still ordinary, especially in the least developed countries (LDCs) such as Tanzania, where the budget for education is paltry. This study aims to measure anthropometric data of Zanzibar University students and furniture dimensions in different classrooms at the university, provide ergonomically compliant data for university furniture design and furniture manufacture, and promote the comfort level and health condition of university youth in Tanzania.

## Method

### Subjects

Two hundred eighty-nine students of Zanzibar University were recruited in this study, including 167 females and 122 males. The subjects were between 18-27 ages (mean age for Diploma  $18.8 \pm 1.3$  years, for Degree  $24.4 \pm 1.5$  years, height  $158.2 \pm 12.1$  cm, weight  $57.0 \pm 3.2$  kg). The sample size was determined based on the equation of Yamane T (1967).

### Anthropometric measurements

The study looked at eight different body dimensions in standing and sitting positions, including stature, popliteal height, buttock-popliteal length, thigh thickness, hip width, shoulder height, knee height, and elbow height with reference to Fidelis et al. (2019).

### Furniture measurements

Four types of classroom furniture are commonly used at Zanzibar University (Figure 1). We measured seat height, seat depth, seat width, seat-to-desk clearance, seat-to-desk height, desk depth, desk height, desk width, backrest height, and backrest width using an inextensible tape measure.



(a) Desks and chairs in the library



(b) Chairs with mounted desktop in law class



(c) Tip-up seat in the theatre hall



(d) Desks and chairs in the computer lab

Figure 1: Four Types of Existing Classroom Furniture at Zanzibar University

### Statistics

Data were analysed with Jamovi 2.3. Test-retest reliability of anthropometric measurements was calculated before formal data collection. The independent t-test was used to compare the gender differences. Statistical significance was set at  $p < 0.05$ .

### Results

Table 1. Match and Mismatch Rates between Furniture Dimensions and Anthropometric Measures.

	Seat width	Seat depth	Seat height	Desktop height	Seat to desk clearance	Backrest height
Match	15.05%	36.07%	0.00%	6.49%	77.08%	14.45%
Higher mismatch	81.40%	52.16%	100.00%	93.08%	22.92%	19.29%
Lower mismatch	3.55%	11.76%	0.00%	0.43%	0.00%	66.26%

Results found significant gender differences in stature (*male*  $160.5 \pm 10.6$ , *female*  $156.4 \pm 12.8$ ,  $p = 0.004$ ), shoulder height (*male*  $48.4 \pm 6.8$ , *female*  $51.3 \pm 7.2$ ,  $p < 0.001$ ), elbow height (*male*  $17.6 \pm 5.2$ , *female*  $20.6 \pm 5.9$ ,  $p < 0.001$ ) and knee height (*male*  $47.8 \pm 4.9$ , *female*  $49.7 \pm 5.1$ ,  $p = 0.0017$ ). Table 1 shows the results of match and mismatch rates, which were averaged between genders and classrooms. The results indicated high rates of mismatches between the existing classroom furniture and the body dimensions of the students, with higher seat height (100%), desktop height (93.08%) and seat width (75.43%), and lower backrest (66.26%). It is consistent with the interviews with local furniture makers that school furniture used at Zanzibar university was designed and produced without the knowledge of local students' dimensions. When compared with similar studies conducted in Nigeria (Ismaila et al. 2014, Fidelis et al. 2018), Iran (Dianat et al. 2013), and Turkey (Kahya E 2018), the results of the present study suggest that the existing university furniture at Zanzibar University is ill-fitted for the university youth for both males and females.

## Reference

- Oyewole, S. A., Haight, J. M. and Freivalds, A. (2010) 'The ergonomic design of classroom furniture/computer work station for first graders in the elementary school', *International Journal of Industrial Ergonomics*, 40(4), pp. 437-447.