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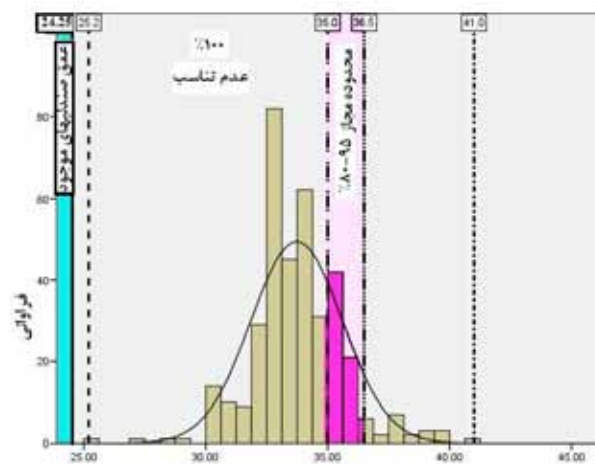
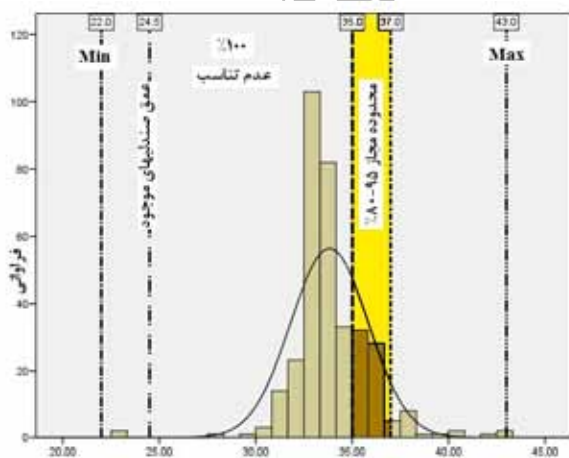
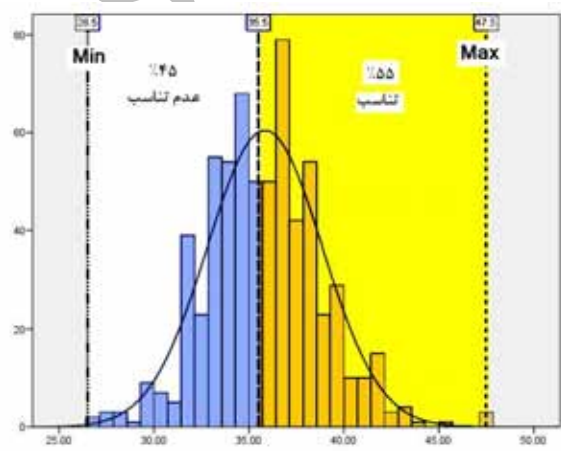
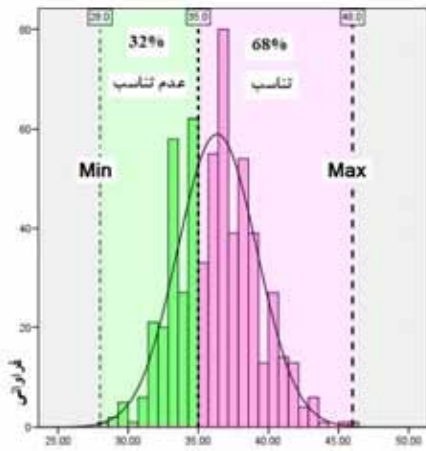
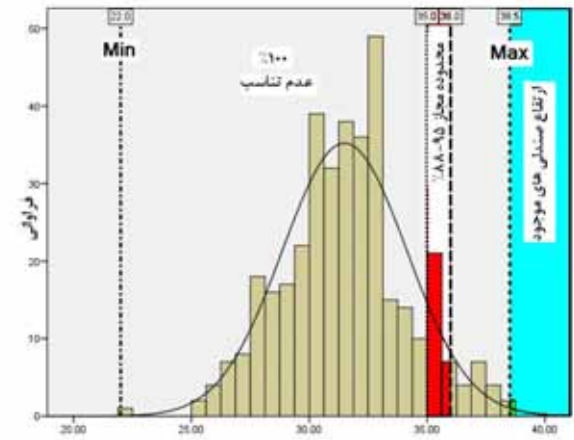
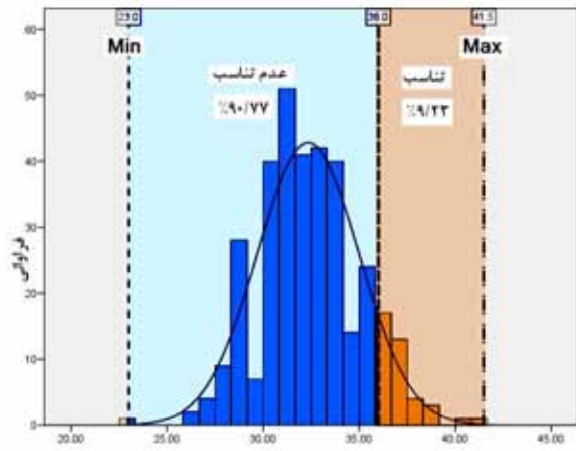
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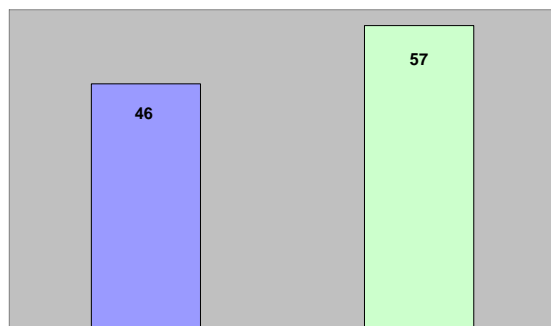
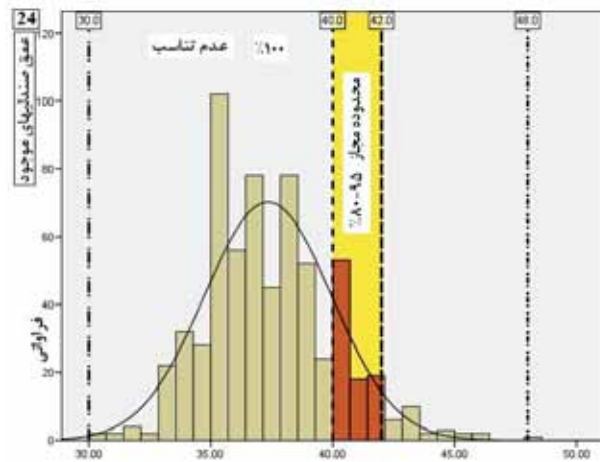
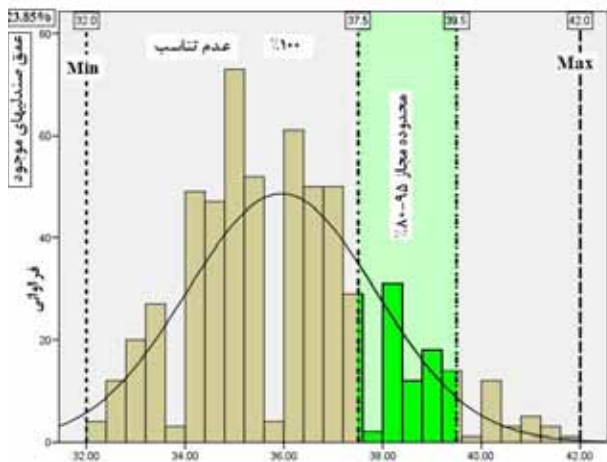
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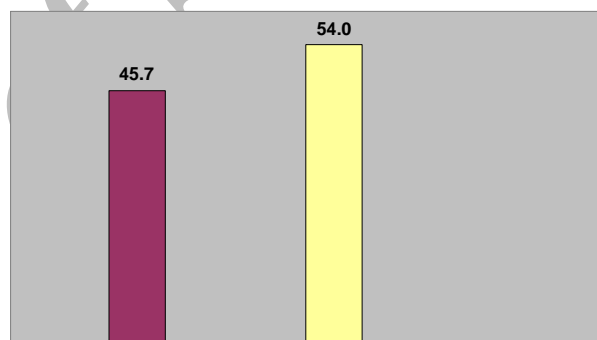




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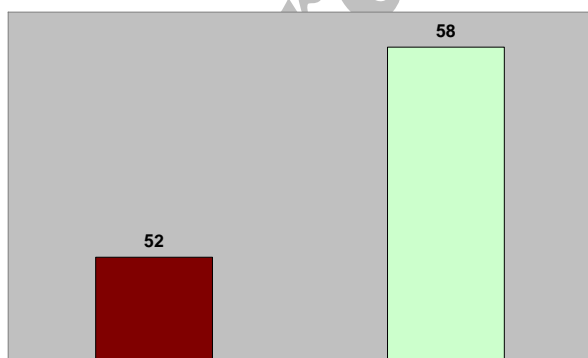
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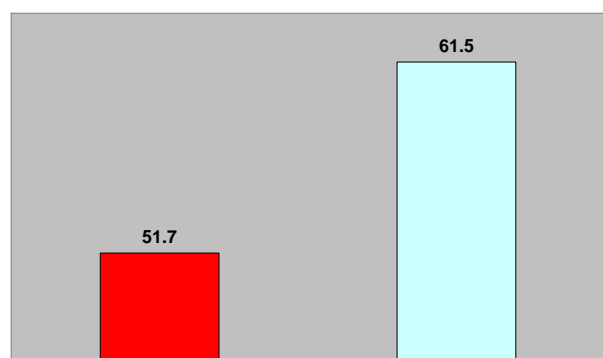
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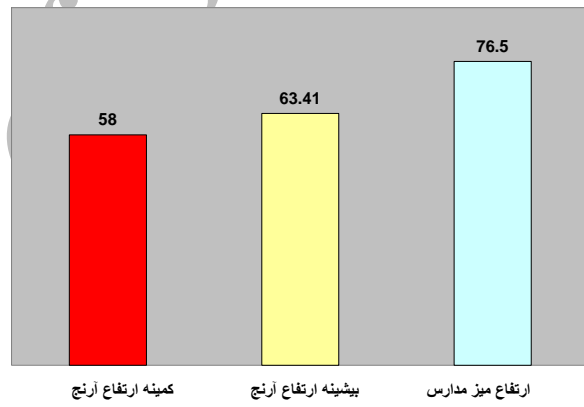
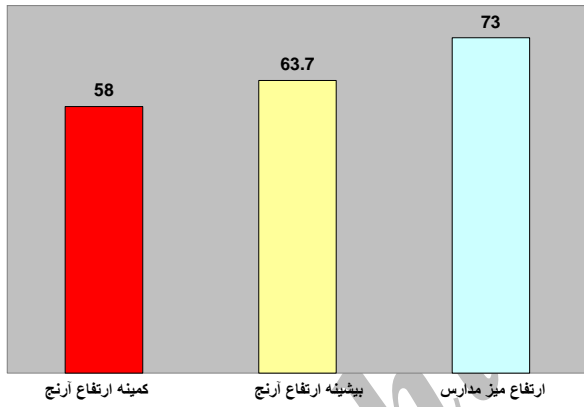
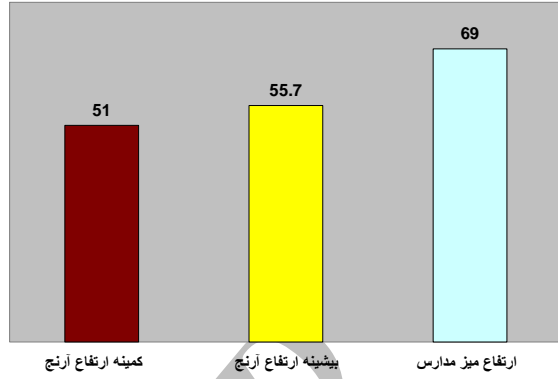
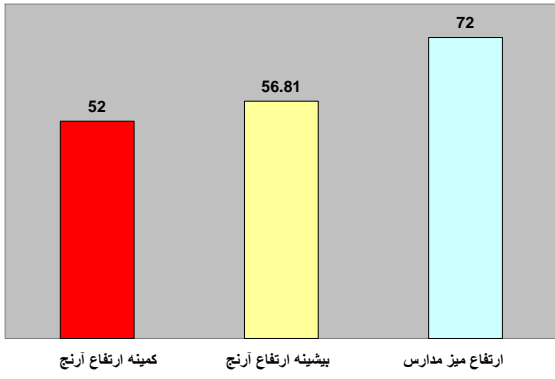
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- 6-Agaard-Hansen J., P. Saval, P. Steino, A. Storr-Paulsen, 2001. Back Health of Student, European Journal of Applied Psychology, Volume 85, Issue 1-2, Pages 41-48.
- 7-Balague, F., G. Dutoit, G. Waldburger, 1988. Low Back Pain in Schoolchildren, Scandinavian Journal of Rehabilitation Medicine, 20, 175-179.
- 8-Bendix, T., 1987. Adjustment of The Seated Workplace with Special Reference to Heights and Inclinations of Seat and Table, Dan. Med. Bull, 34 (3), 125-139.

-
- 9-Bradford, D.S., J. E. Lonstein, J. H. Moe, J. W. Ogilvie, R. B. Winter, 1994. *Moe's Textbook of Scoliosis and Other Spinal Deformities*, third ed. W.B.Saunders, Philadelphia.
- 10-Briethecker, D., 2003. Federal Working Group of Posture and Movement, Wiesbaden, Germany, A Presentation at an education conference in Hobart, Tasmania.
- 11-Brunswic, M., 1984. Ergonomics of Seat Design, *Physiotherapy* 70 (2), 40–43.
- 12-Burton, A. K., R. D. Clarke, T. D. McClune, K. M. Tillotson, 1996. The Natural History of Low-back Pain in Adolescents, *Spine*, 21, 2323-2328.
- 13-Chaffin, D., G. Anderson, 1991. *Occupational Biomechanics*, New York: Wiley.
- 14-Cranz, G., 2000. The Alexander Technique in The World of Design: Posture and The Common Chair, *J. Bodywork Movement Ther.* 4 (2), 90–98.
- 15-Diep, N.B., 2003. Evaluation of Fitness between School Furniture and Children Body Size in Haiphong, Vietnam [dissertation], Vietnam: Lulea Institute of Technology.
- 16-Drury, C. G., B. G. Coury, 1982. A Methodology for Chair Evaluation, *Applied Ergonomics* 13 (3), 195–202.
- 17-Evans, W.A., A. J. Courtney, K. F. Fok, 1988. The Design of School Furniture for Hong Kong, Schoolchildren, *Applied Ergonomics*, vol. 19(1), 122-134.
- 18-Floyd and Ward, 1969. Anthropometric and Physiological Considerations in School Office and Factory Seating, *Ergonomics*, 12(2), 132-139.
- 19-Freedman, D. S., L. K. Khan, M. K.Serdula, S. R. Srinivasan, G. S. Berenson, 2000. Secular Trends in Height among Adolescent Medicine, 154 (2), 155–161.
- 20-Genaidy, A. M., W. Karwowski, 1993. The Effects of Neutral Posture Deviation on Perceived Joint Discomfort Ratings in Sitting and Standing Postures, *Ergonomics* 36, 785-792.
- 21-Hänninen, O., R. Koskelo, 2002. Adjustable Tables and Chairs Correct Posture and Lower Muscle Tension and Pain in High School Students [dissertation], University of Kuopio.
- 22-Harris, C., L. Straker, 2000. Survey of Physical Ergonomics Issues Associated With School Children's Use of Laptop Computers. *International Journal of Industrial Ergonomics*, 26, 337-346.
- 23-Hill, A. 2005. Your Back in The Future, www.stagesystems.co.uk, www.backcare.org.uk. Back in the Future. Pdf.
- 24-Jeong, B.Y. K. S. Park, 1990. Sex Differences in Anthropometry for School Furniture Design, *Ergonomics* 33 1511-21.
- 25-Kanea, P.J., M. Pilcherb, S. J. Leggc, 2003. Development of a Furniture System to Match Student Needs in New Zealand Schools.
- 26-Knight, G., J. Noyes, 1999. Children's Behaviour and The Design of School Furniture, *Ergonomics* 42 (5), 747–760.
- 27-Legg, S. J., K. Pajo, M. Sullman, M. Marfell-Jones., 2003. Mismatch Between Classroom Furniture Dimensions and Student Anthropometric Characteristics in Three New Zealand Secondary Schools, *Proceedings of the 15th Congress of the International Ergonomics Association, Ergonomics for Children in Educational Environments Symposium*, 6, 395-7, Seoul, Korea, 24-29 August 2003a.
- 28-Lilia, R., A. Prado – Leon, 2001. Anthropometric Study of Mexican Primary School Children, *Applied Ergonomics*; 32(8): 339-345.

...

- 29-Lin, R., Y. Y. Kang, 2000. Ergonomic Design for Senior High School Furniture in Taiwan, Proceedings of the International ergonomics Association/ Human Factors Society Congress, San Diego, USA, 6:39-42.
- 30-Mandal, A., 1982. The Correct Height of School Furniture. *Human Factors* 24(3), 257-269.
- 31-Marschall, M., A. Harrington, J. Steele, 1995. Effect of Workstation Design on Sitting Posture in Young Children, *Ergonomics*, 38/9, 1932-1940.
- 32-Milanese, S. and K. Grimmer., 2004. School furniture and the user population: an anthropometric perspective, *Ergonomics*, Vol 47, No 4, 416 – 426.
- 33-Molenbroek, J., R. Bruin, 2005. Enhancing the use of anthropometric data.
<http://www2.io.tudelft.nl/research/ergonomics/AED/publications/enhancing%20anthropometry.pdf>
- 34-Moon, J. H., M. J. Kang, J. K. Kang, S. W. Kang, G. H. Kim, 1995. Evaluation of spinal deformity in Korean female high school student. *Journal of Korean Academy of Rehabilitation Medicine* 19 (4), 846–852.
- 35-Moore, B., S. S. Dorrel, C. A. Halpern, J. E. Fernandez, 1992. The Ergonomic Evaluation of Several Chairs: a case study, *Advances in Industrial Ergonomics and Safety IV*, Taylor & Francis, London, pp. 267–274.
- 36-Murphy, S., P. Buckle, D. Stubbs, 2004. Classroom Posture and Self-reported Back and Neck Pain in Schoolchildren, *Applied Ergonomics*, 35, 2, 113-120.
- 37-Panagiotopoulou, G., K. Christoulas, A. Papanckolaou, K. Mandroukas, 2004. Classroom Furniture Dimensions and Anthropometric Measures in Primary School, *Appl Erg* 35 121-8.
- 38-Parcells, C., M. Stommel, R. P. Hubbard, 1999. Mismatch of Classroom Furniture and Student Body Dimensions: Empirical Findings and Health Implications, College of Nursing, Michigan State University, East Lansing 48824, USA.
- 39-Pheasant, S., 1996. *Bodyspace: Anthropometry, Ergonomics & the design of work*, 2nd edition, Taylor & Francis Books Ltd.
- 40-Salminen, J. J., J. Pentti, P. Terho, 1992. Low Back Pain and Disability in 14-year-old School Children, *Acta Paediatrica Scandinavia*, 81, 1035-1039.
- 41-Tichauer, E., 1978. *The Biomechanical Basis of Ergonomics: Anatomy Applied to The Design of Work Situations*, New York: Wiley.
- 42-Trevelyan, F. C., S. J. Legg, 2006. Back Pain in School Children – Where to from Here?, *Applied Ergonomics*, Special Issue: Fundamental Reviews, 37 (1), 45-54.
- 43-Wilson, K., 1997. Laptops a Pain in Neck, *Herald Sun*, Melbourne 5 August, 7.
- 44-Yeats B., 1997. Factors that May Influence the Postural Health of Schoolchildren, *Work* 9 45.
- 45-Zacharkow, D., 1988. *Posture: Sitting, Chair Design and Exercise*, Springfield, IL: CC Thomas.

Evaluation of mismatch between school furniture dimensions and students anthropometric characteristics in Karaj primary schools, Iran

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Abstract

Mismatch between the school furniture and body dimension of children is one of the important factors affecting the deformation of spinal column and causing low back pain. In addition, it can be a prefactor for mental disorders. Also, it causes bad-temper and bad-behaviour in students. Lack of normative anthropometric measurements of Iranian children, serving as a basis for furniture construction, could be the reason for this problem. The purpose of the present study is the optimization of ergonomic factors to design school furniture based on students anthropometric characteristics for increasing students' health. 2,000 students (M:1,000, F:1,000) in primary schools ranging 6-11 years old in Karaj city, from 4 education areas, were randomly chosen, 16 primary schools and 25 students from each class of every 16 schools on the basis of BSI5873 standard. They were then divided into 2 age groups, 6-8 & 8-11, and the seated anthropometric characteristics like popliteal height, buttock-popliteal length, and knee height were measured. Also the furniture dimensions were measured to compare with the measured anthropometric items: Desk height, desk clearance, seat depths, and seat heights were measured. The data were analyzed with Minitab ver 15 & Statistica ver. 7 Softwares. The results showed, except knee clearance, none of school furniture measurements are in the range of pupils' body dimensions. It was concluded that the design and manufacturing of school furniture are done without any attention to anthropometric rules and in future it might put the health of the society at risk.

Keywords: Anthropometric, School furniture, School children, Ergonomy, Musculo Skeletal Disorder, Lumber back pain

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