RESEARCH ON THE DESIGN OF NAP DESKS AND CHAIRS OF PRIMARY AND MIDDLE SCHOOL STUDENTS BASED ON ERGONOMICS

Li Zhijun, 228 ME in Mechanics, Year 1
*Jiang Xinyu, Doctor, Associate Professor, Department of Machinery,
Yuan Xinyi, 218 ME in Mechanics, Year 2
Liu Zhenming, 211 ME in Mechanics, Year 2
Donghua University
Shanghai

Abstract: This study focuses on meeting the needs of primary and secondary school students napping in the classroom, and probing the design of classroom napping desks and chairs suitable for primary and secondary school students based on ergonomics as the theoretical basis. There are no good solutions to the problem of classroom napping for primary and secondary school students in China, and there are few scientific studies on the subject. Through preliminary research and on-the-spot investigations, the pain points and core structural problems of primary and secondary school students napping in the classroom were learned, in terms of materials, structures and scenarios, practical solutions were proposed, and a set of ergonomic desks and chairs that meet the needs of primary and middle school students napping and classes were designed, providing a scientific and reasonable research method and demonstration cases for future exploration of the problem of primary and middle school students napping.

Key words: Primary and secondary school students; Nap; Desks and chairs; Ergonomics.

0 Introduction

With the rapid development of economy in China , the government and society attach great importance to the quality of school life and practice of students in the quality education stage. Relevant studies have shown that taking a proper nap for primary and secondary school students can not only bring physical and mental relaxation, but also significantly improve the learning efficiency in the afternoon and evening. However, most primary and secondary schools in China do not provide a good lunch break environment for students, students can only "sleep on the table" in the classroom, the quality of rest is not guaranteed, which is very harmful to the body of primary and secondary school students who are still in the growth stage,and there are also certain safety risks. Therefore, it has become an urgent demand from the society and parents to ask schools and related research institutions to properly solve the nap problem of primary and secondary school students.

1. Research Status

Due to the large number of primary and secondary school students at home and abroad, there is no lack of research on classroom desks and chairs for them, but there

are still a few studies on classroom nap desks and chairs, which shows that this research has certain potential and development space. Siesta has a great impact on the physical and mental health of primary and secondary school students. Many scholars have conducted rich research on the current situation of napping in classrooms of primary and secondary school students and the ergonomics of desks and chairs.

1.1 Researchs on the Current Situation of Siesta of Primary and Middle School Students

Li Xigui [1] (2008) analyzed data on both nap patterns and learning efficiency by conducting a survey in Weifang, China, and found that a reasonable nap duration would improve students' learning efficiency, providing data to support the optimization of students' nap schedules. Huang Yuqi [2] (2017) conducted a questionnaire survey on high school students of different levels in Foshan City, China, and explored the relationship between their nap style and learning efficiency through a nap experiment. At the same time, the mathematical model was used to analyze the experimental data. The more scientific nap time and nap methods for primary and middle school students are obtained, and some suggestions are provided for the nap program of primary and middle school students.

1.2 Ergonomics study of desks and chairs for primary and secondary school students

Scholars also optimize the design of classroom seats from the perspective of ergonomics. Linton, Steven J et al. [3] (1994) studied the impact of ergonomically designed furniture on students' attitudes, skeletal symptoms, and behaviors . the comfort of school furniture were tested and the sitting posture and characteristics of students were measured, and the results showed that students' sitting needs to be properly guided with good desk and chair design. Carneiro V et al. [4] (2017) in order to find a universal desk and chair measurement basis suitable for any country, using data from different countries as an example, proposed a universal chair and desk height measurement system, matching equations, etc. 5 dimensional requirements for implementing a new school furniture measurement system in classrooms of elementary and middle school students are obtained. Zhang Chunqiang et al. [5] (2018) analyzed the relationship between human body size and height based on the Chinese minor body size standard, and calculated the standard height corresponding to learning by means of average method, regression analysis method and linear interpolation method. The human body size related to the seat, the accuracy and comfort of the relevant size are actually measured and verified, and the relevant parameters of the seat for minors are determined by using the principles of ergonomics.

2. Research ideas and methods

In the preliminary analysis part of this study, a considerable amount of user interview data and questionnaire research results were obtained through the use of user research, fieldwork and literature research. At the same time for the existing desks and chairs on the market to carry out field surveys, the classroom environment and the behavior of primary and secondary school students to make careful observations, conclude with an extensive case study of the nap model for which research results are available; In the product design stage, product models are generated through

functional design, structural design, material determination and appearance design in response to the summarized pain points; Finally, in the product evaluation stage, the pressure measurement system X-sensor is used to analyze and evaluate the products in sitting and lying postures to obtain objective data, Then obtain the subjective evaluation of the direct user, and obtain a nap desk and chair that meets the ergonomics and subjective evaluation of a high, the specific logical framework is shown in Fig 1.

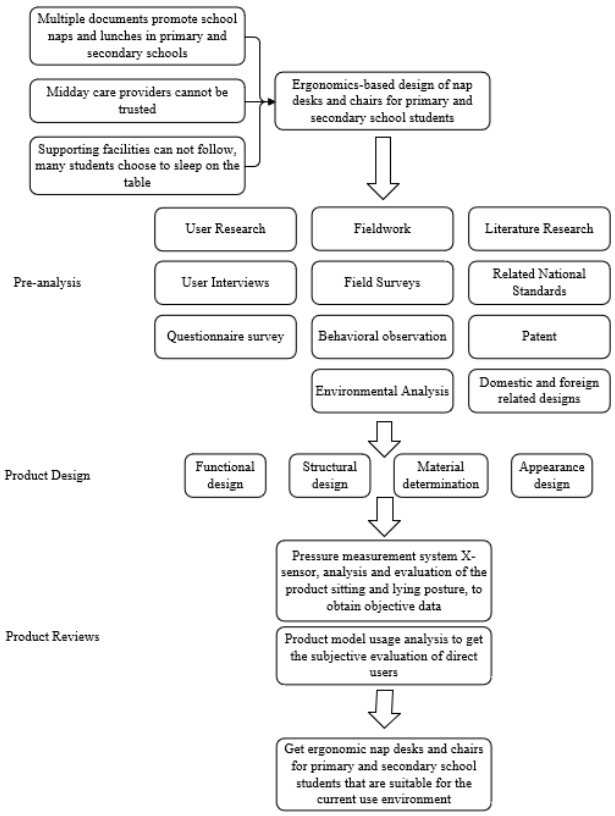

Fig 1 Research ideas and methods

3. Conclusion

Based on the actual research data, it is found that at this stage, the nap solution suitable for a wide range of primary and secondary school students is to have "sleep on your back" and "sleep on the table" two nap positions, compared to a separate nap room solution, the design of the desk and chair has a better economic effect. The traditional way of sleeping on the table is mostly sleeping on the arms, which will lead to multiple nerve compression, at the same time, due to napping often anxiety in the mind, sleep is not solid, and sleep eye compression, after the nap will usually appear temporary blurred vision. For a long time, this will cause high intraocular pressure, which over time will make the eye bulge, eye axis growth, the formation of high myopia, but also easy to increase the incidence of glaucoma. The most serious problem of sleeping on your back is the frequency of spinal problems, due to the nap when the shoulders are constricted, the cervical vertebrae are excessively bent, the whole neck and shoulder arms group in a narrow area, so almost all the relevant muscles are in a state of passive shortening tension, a few minutes down, it is easy to cause stiffness of the neck or shoulders. Overall, the transformation program for

lying down to sleep is relatively limited, the more appropriate way only to increase the height of the mat, while using soft mat material, which can optimize the spine nap curve can also reduce the sense of nerve compression. Therefore, this study chose to focus on the design of the napping method is "sleep on your back" - leaning napping. Research shows that the muscles of the back and neck are most relaxed when sleeping lying down, and there is little pressure on the spine, which is conducive to falling asleep. From the ergonomic point of view, desks and chairs should ideally have size and angle adjustment functions, while making full use of the multi-component composition of desks and chairs and their general characteristics of the amount of space they occupy to expand the space for our optimal design. A comprehensive view of the desks and chairs products should be from the product adaptability, adjustment simplicity, multi-function and economic, sustainable aspects of the optimal design strategy.

The above research and design points are summarized, and the final three views of the program and usage scenarios are generated, as shown in Fig 2 - Fig 7 below:

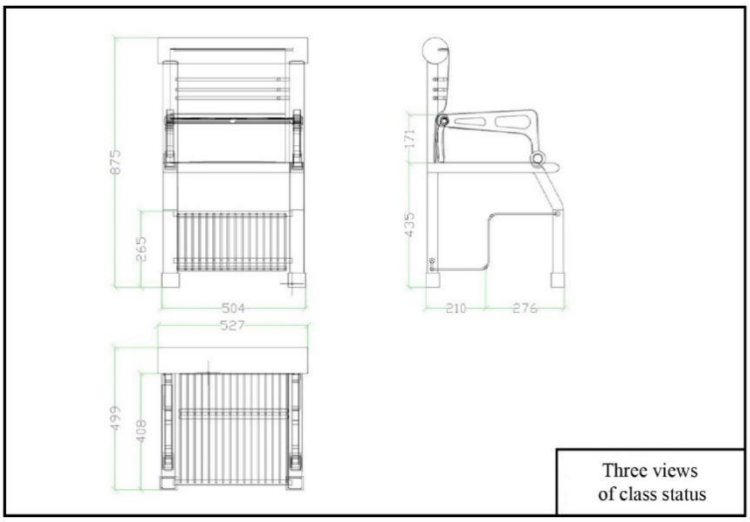

Fig 2: Three views of desks during class

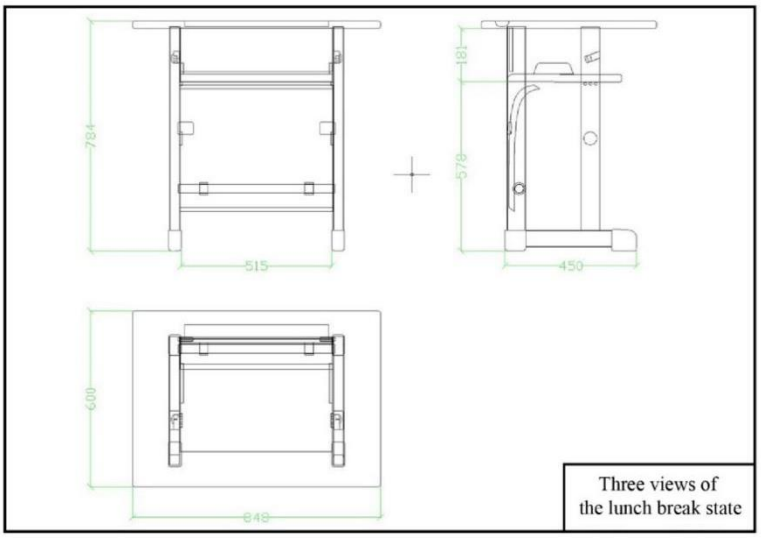

Fig 3: Three views of the chair during class

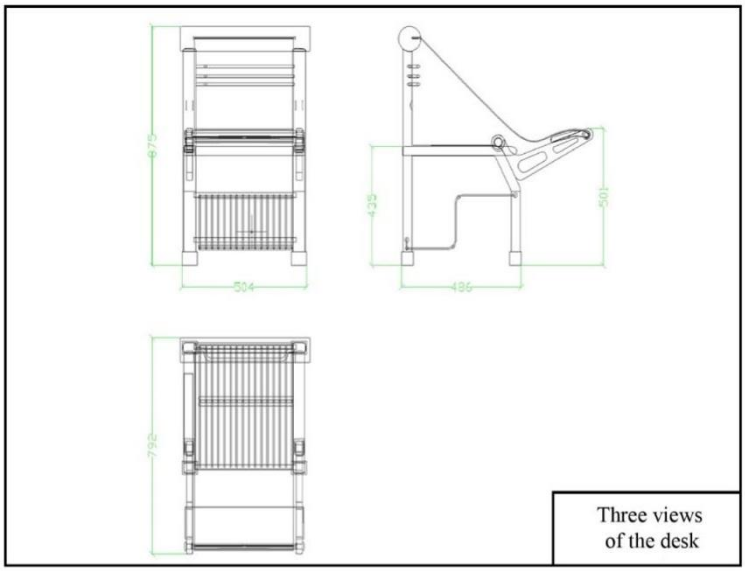

Fig 4: Three views of the desk during the nap state

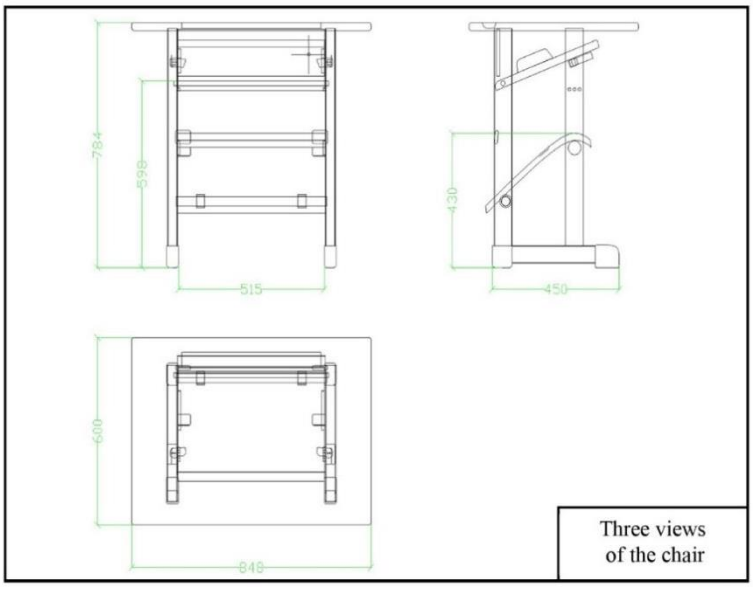

Fig 5: Three views of the desk during the nap state

Fig 6: Usage scenario during class status

Fig 7: The use of scenarios during the nap state

From the beginning of the research, this study strictly follows the research method, in accordance with the principle of random sampling, and receives a scientific and reasonable research report, so as to conduct research and analysis, and combines the current situation of Chinese primary and secondary school students' lunch break at school, using the multi-functional design of desks and chairs, modular design, folding and sliding design, etc. to efficiently use space and reasonably allocate classroom space within the limited space, and at the same time, according to the existing national standard specification requirements and research results, in the design of strict reference to ergonomic data, through the scientific improvement program of desks and chairs, generated a personalized design of primary and secondary school students' nap desks and chairs. The research results are suitable for use in Chinese primary and secondary school students' classroom naps and can lead to a healthy and orderly school life for primary and secondary school students.

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