

The use of college students' suitcases and experimental design

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Abstract. Although the technology is gradually developing, and the suitcase is gradually developing towards intelligence and convenience, which has become an indispensable existence for carrying out work, there are still many problems in the use of the suitcase. In order to grasp the future development trend of suitcases, understand the shortcomings of suitcases at this stage, and meet the needs of some people, I conducted a questionnaire survey on 18 college students and invited them to participate in the experiment. According to the volunteers' responses in the questionnaire, "stair handling" is the most difficult scenario for using suitcases. Design the experiment based on this data, and invite volunteers to participate in the experimental design, record the most commonly used ways of volunteers when carrying stairs, and analyze the final statistical results.

Keywords: Questionnaire survey, experiment design, College Students.

1. Introduction

1.1. Research background, problems and purpose

With the continuous development of regional economy and infrastructure and perfection, whether to go out to work or long distance learning, suitcases are an integral part of the portable receive tools, now the suitcases are moving in the direction of intelligent and comfortable, but for the comfort level of the luggage rod design and not a lot of innovation and research, in order to meet the requirements of part of the crowd, This paper mainly for college students to experiment and observation, so this article according to the experiment request (in Chinese adults average height as a benchmark, and take two range respectively, a total of six groups of experiment) invited 18 college students, before experiment, fill in the questionnaire, to understand the volunteers for existing luggage pull rod. In order to explore the comfort zone of men and women with different heights under different movements, the experiment was designed synchronously with different life scenes, to explore the behaviors and movements of volunteers when using the suitcase pull rod, analyze and summarize the final experimental results, and finally draw a conclusion. To a certain extent, it is helpful for the design of suitcase pull bar in the future.

1.2. Research status at home and abroad

The earliest suitcase can be traced back to the wooden suitcase in the 1920s. At that time, transportation and transportation were not convenient. Such suitcase was the best choice for people when traveling or on business. With the continuous development of science and technology, in the late World War II, with the continuous progress of aircraft technology, a light suitcase made of magnesium and propylene butadiene styrene polymer appeared, It has greatly facilitated people's travel. At the end of the 1960s, ABS briefcases specially designed for elite personnel were launched. In the 1970s, Samsonite designed travel cases with wheels, which opened the prelude to the great revolution of travel cases. In the mid-1990s, Samsonite designed four-wheel travel cases, greatly reducing people's burden on the journey. Today, in the 21st century, China's economy is developing rapidly, and regional economy and infrastructure construction are constantly developing and improving. Under such a background, the suitcase industry has also ushered in tremendous development and changes. The shape of the suitcase is gradually developing toward diversification, and the intelligent and diversified aspects are also constantly meeting the needs of different people.

Various suitcase brands have launched different materials of suitcases to meet the different needs of consumers, For example, it adopts super waterproof fabric, Vientiane shock-absorbing wheel, aluminum alloy pull rod, or high-quality PC alloy material, super compression and scratch resistant panel and other materials for large-capacity travel cases.

However, the larger suitcase capacity also brings inconvenience to people's travel to a certain extent, and it is not easy to store, carry and carry. Large capacity boxes and convenient carrying are mutually restricted, but they can be balanced by some ingenious design ideas. In order to observe people's behavior and habits in using suitcases and explore further satisfaction in innovative design of suitcases, I conducted a questionnaire survey on college students, and invited them to participate in the experiment to experience the carrying and carrying of suitcases in different scenarios, and summarized and discussed the experimental results to provide some new ideas for the design of suitcases in the future.

1.3. The studied content

The main research content of this paper is aimed at the habit and data statistics of college students using suitcases when they return to school. According to the experimental requirements, the experimental subjects are selected, and the number of the existing two kinds of suitcases using the pull rod design ("t" single pull rod "and" U "double pull rod) in college students is counted, and the reasons are analyzed. The volunteers who fill in the questionnaire are invited to carry out the experiment, By simulating the different scenarios (walking on the ground, dragging on the slope, and carrying on the stairs) of college students carrying suitcases during their return to school, we will test the solutions adopted by volunteers under different heights and genders, and record and analyze the appropriate height, area, and problems faced by the suitcase pull rod. Understand people's actual demand for suitcases, and the more suitable suitcases will be more competitive in the market. Therefore, through the study of the influence of different actions on the structural comfort of the trolley, and through the analysis of the experimental results, the structural distance of the pull rod that is more suitable for the handling operation is obtained, and the suggestions for more comfortable design of the pull rod of the suitcase are put forward.

2. Methods

2.1. Participant

The volunteers recruited in this experiment are all between 18 and 22 years old. According to the average height data of Chinese men and women in 2022, the average height of Chinese women is 155.8 cm (one decimal place), and the average height of men is 167.1 cm (one decimal place). Based on the above data and combined with the actual situation, a total of 18 volunteers were invited to fill in the questionnaire and participate in the experiment. Among them, there were three female volunteers whose height was below 155.8, three volunteers whose height was between 155.8 and 165.8, and three volunteers whose height was above 165.8. There were three male volunteers with height below 167.1, three volunteers with height between 167.1 and 177.1, and three volunteers with height above 177.1.

2.2. Experimental design

First, the volunteers were asked to measure their height and determine that the number of people in different groups was equal. Then, a questionnaire was conducted to analyze the final results, so as to determine the priority of the simulation scene. There is one scene simulations in this experiment, dragging on the slope and moving on the stairs. Experimental prop: 24 inch "U" double pull rod suitcase with a weight of 15 kg Site requirements: Stair terrain with width of 900mm and height of 160mm and total height of 1920mm.

1) Stair handling

Volunteers carry a 15kg suitcase (the outside of the suitcase is wrapped with foam paper to record the area and height of the suitcase in contact with the stairs during the transportation process) to carry out the stair transportation. The transportation experiment is carried out on the stair terrain with a width of 900mm, a height of 160mm and a total height of 1920mm. There is no requirement for the carrying action of the volunteers during the test. It can be carried according to the most comfortable and labor-saving action of the volunteers, Record the feedback from volunteers.

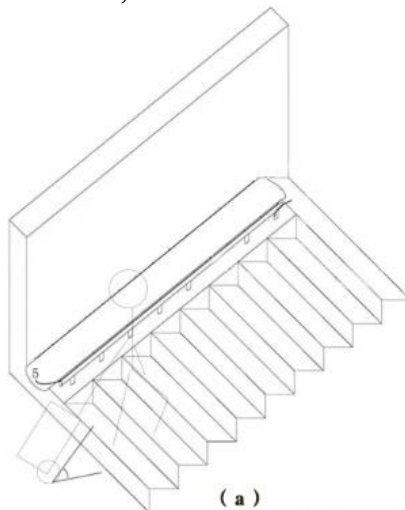


Figure 1. The Stair handling

2) Questionnaire design:

Dear students:

Hello! Please read the questions and answers carefully first, and then fill in the questions one by one according to your opinions on the topic description. The answers of this questionnaire are not good or bad, and the results of the questionnaire are only for group analysis, without any individual presentation. It is absolutely confidential. Please fill in the questionnaire according to the actual situation and real thoughts.

Here, I would like to express my heartfelt thanks for your cooperation and support!

1. The type of suitcase you use when returning to school is:

A hand held B single pole pull C arm sling, hand held D double pole pull

2. How often do you use your suitcase every year:

A. 2 times and below; B.4 times; C.4 times and above

3. When you return to school every year, please choose the most difficult scenario to use the suitcase from the following scenarios?

A. Walking on flat ground; B. stair handling; C. uphill dragging; D. downhill

4. What is your requirement for suitcase size?

A is less than 30cm long (below knee); B is 30cm-45cm long (knee); C is 45cm-60cm long (5cm above knee) ; D is 60cm-75cm long (10cm above knee) e is more than 75cm long (thigh)

5. The average weight of your suitcase is:

A. Below 10kg, b.10-15kg, c.15kg and above

6. Have you followed or purchased a multi-functional suitcase?

A. Buy and pay attention to; B. buy but don't understand; C. only pay attention to not buy; D. not buy and pay attention to personal data

7. What is your gender?

A. Male; B. Female

8. How tall are you?

(female) A. Under 155.8 cm; B. 155.8-165.8 cm; C. Over 165.8 cm

(male) A. Below 167.1 cm; B. 167.1-177.1 cm; C. Over 177.1 cm

9. Do you go to school in another place or locally?

3. Results

3.1. Data analysis

Through investigation and Research on the demand and use frequency of travel cases of college students, we can better understand the market situation of travel cases of college students, and then explore the shortcomings of the existing travel case market, so as to put forward development suggestions, improve the shortcomings, and grasp the future design trend and the College student market.

1) The type of suitcase you use when returning to school is:

A hand held B single pole pull C arm sling, hand held D double pole pull

Table 1. Volunteer Data Statistics

	A hand held	B single pole pull	C arm sling	D double pole pull
Male	0	0	0	9
female	0	2	0	7

Among men and women, 9 and 7 chose double tie rods, respectively, which were the most popular choice. Second, two women opted for a single tie rod. In further investigation of the causes, among the reasons why the double rod pull became the most chosen, the most common answer was more stable and convenient. The main reason the two respondents who chose a single tie rod was the more refined appearance.

From this, it can be concluded that the appearance will also affect people's choice of suitcases to a certain extent. Even in the selection of functional pull rods, the stability and convenience of double rod pulling are still the first choice in the minds of most students.

2) How often do you use your suitcase every year?

A. 2 times and below; B. 4 times; C. 4 times and above

Table 2. Volunteer Data Statistics

	A 2 times and below	B 4 times	C 4 times above
Male	2	4	3
female	3	5	1

3) When you return to school every year, please choose the most difficult scenario to use the suitcase from the following scenarios?

A. Walking on flat ground; B. stair handling; C. uphill dragging; D. downhill

Table 3. Volunteer Data Statistics

	A Walking on flat ground	B stair handling	C up hill dragging	D down hill
Male	0	9	0	0
female	0	7	2	0

Most of the girls and all the boys think that the most difficult scene to use the suitcase is going up the stairs, but some think that going uphill will also make the suitcase difficult to use.

4) What is your requirement for suitcase size?

A is less than 30cm long (below knee); B is 30cm-45cm long (knee); C is 45cm-60cm long (5cm above knee); D is 60cm-75cm long (10cm above knee) e is more than 75cm long (thigh)

Table 4. Volunteer Data Statistics

	A is less than 30cm long (below knee)	B is 30cm-45cm long (knee)	C is 45cm-60cm long (5cm above knee)	D is 60cm-75cm long (10cm above knee) e is more than 75cm long (thigh)
Male	0	1	3	5
female	0	0	2	7

According to the questionnaire survey, girls prefer to carry large capacity suitcases, while boys choose the same number of medium and large suitcases. Therefore, in the case of returning to school, students tend to choose large capacity suitcases. According to the second survey, the number of students who choose the size of large capacity suitcases is twice that of students who go to school in other places.

5) The average weight of your suitcase is:

Below 10kg, b.10-15kg, c.15kg and above

Table 5. Volunteer Data Statistics

	A Below 10kg	B 10-15kg,	C 15kg and above
Male	0	5	4
female	0	3	6

From the perspective of gender, the average weight of women's suitcases is greater than that of boys' suitcases, while from the perspective of region, the average weight of local students' suitcases is greater than that of foreign students.

6) Have you followed or purchased a multi-functional suitcase?

A. Buy and pay attention to; B. buy but don't understand; C. only pay attention to not buy; D. not buy and pay attention to

Table 6. Volunteer Data Statistics

	A Buy and pay attention to	B buy but don't understand	C only pay attention to not buy	D not buy and pay attention to
Male	1	0	5	3
female	0	1	6	2

According to the survey, intelligent suitcases are not so popular among college students at this stage. Although most college students still pay attention to the information about suitcases, they do not have much willingness to buy them. At this stage, the intelligence of suitcases is still too limited and lacks certain practicality, so they lack a certain share in the market.

3.2. Experimental data results

In this experiment, by recording the way volunteers carry suitcases upstairs, we can find the shortcomings of existing suitcases and analyze them according to the recorded data. The suitcase used in this experiment is 24 inches, and the total height of the pull rod plus the box is 104.5cm, 98.5cm and 92.5cm respectively. In order to have a more intuitive comparison, figures (b)-(d) Comparison of three suitcases with dimensions of 92.5cm, 98.5cm, and 104.5cm and volunteers with a height of 164cm, from left to right.



Figure 2. Experimental procedure and operation

Without considering the damage to the suitcase, we only consider the most labor-saving and comfortable way for volunteers to complete the experiment. What we observed was that there were three different ways to complete the task among the 18 volunteers. The utilization rate of the method in Figure 1 reached 61.1% (accurate to one decimal place), and the utilization rate of figure 2(f) and figure 2(g) was 22.2% and 16.7% respectively.

After further understanding with the volunteers, it can be concluded that these three methods can not achieve labor-saving and comfort at the same time. Although the method shown in Figure 1 is comfortable, it will cause certain damage to the suitcase itself, and it can not be carried upstairs more smoothly. The time efficiency is low. The method in Figure 2(f) is similar to that in Fig. (g), but it is more labor-saving than that in Figure 2(g). However, due to the lack of corresponding support points, the method in Figure 2(g) is simpler and more efficient, but it requires more effort to transport the suitcase to the designated place.

According to the traces left by the foam paper on the suitcases of 18 volunteers, the damaged position of the foam paper of the volunteers who chose the method shown in Figure 2(e) is 0-21cm away from the bottom of the suitcase. From the extrusion shape of the foam paper, the suitcase is more impacted and dragged, and the degree of wear is greater. Compared with the method shown in Figure 2(e), Using the methods shown in Figure 2(f) and Figure 2(g), the suitcase of the volunteers is less squeezed and impacted by the outside. However, when the volunteers have a deep understanding, these two methods do little damage to the suitcase, but they need the volunteers to consume more energy, and there are certain requirements for the physical quality of the volunteers, as shown in Figure 3 and Figure 4.

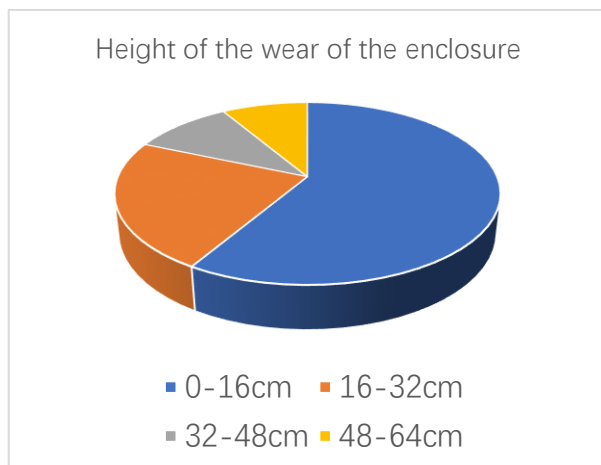


Table 3. Height of the wear of the enclosure

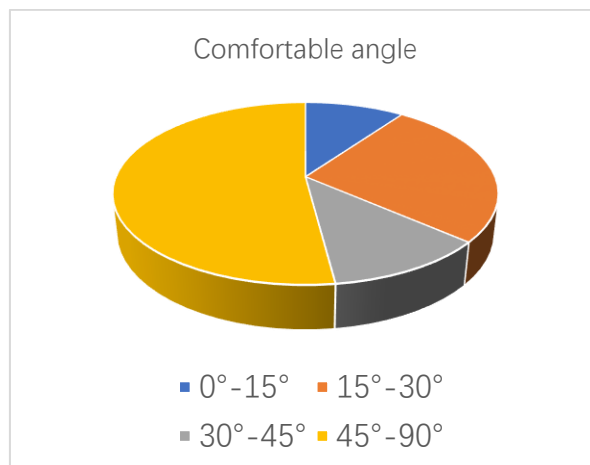


Table 4. Comfortable angle

Therefore, we chose to further study the method in Figure 2 (e). Through the photos and actual measurements left during the experiment, we found that the contact angle between the suitcase and the stairs was about 49° - 90° , and the contact area between the stairs and the side of the suitcase was about 85 square centimeters. This angle is related to the contact surface and the height of the volunteers. The higher the person, the smaller the contact area, but the more physical exertion of the volunteers.

4. Conclusion

After in-depth understanding of college students' use of suitcases and in-depth understanding of smart suitcases, perhaps there is still a lack of a smart suitcase for college students in the market. In practical applications, the existing smart suitcases lack certain practicality and pertinence, and cannot really solve the difficulties encountered by college students when using them.

Nowadays, in the post-epidemic era, college students have been affected by the epidemic and have been locked down for a long time. Even local students can not go home at any time, so every time they return to school, the role of luggage in storage has been significantly improved, more students hope that luggage can be more portable and labor-saving in the process of carrying, not only in transportation can be more convenient, but also hope that smart suitcases can pay more attention to college students, seize the college student market, and constantly improve the shortcomings of existing suitcases.

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