The Usability of Campus Card Transfer Machine Research Based on Service Design

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***Abstract*—[Purpose]Conduct usability testing on campus transfer machine self-service, sort out and analyze the service availability, and find directions and goals for self-service technology in campus context. [Method]Taking South China University of Technology as an example, through the service blueprint method, the existing service processes and contact points are searched for task entry points. The questionnaires are used to find the two most frequently used self-services, and 20 users were randomly invited to complete these two task tests in the established application context. The collaborative process and the vocal thinking method are used in the test process, and the test data is compiled by the retrospective test method, the research samples need to fill in the SUS questionnaire after completing the task, evaluate availability through three dimensions of satisfaction, effectiveness, and efficiency. Dimensions to assess their usability. Finally, the observation of 20 research samples is summarized in the usability problem, and the results are summarized and analyzed through comparative test. [Results] Low availability score for existing transfer machines. [Conclusion]The existing campus storage machine has poor service availability, and the problems of visual and cognitive links are prominent. It is proposed that in the design and development stage, user behavior research precedes functional classification; design iteration phase, timely on-demand information architecture matching design suggestions, it has a design guiding role for campus self-service design.**

Keywords—Campus transfer machine self-service; Usability; SUS Scale

I. INTRODUCTION

Along with the high popularity of campus cards, the transfer machines based on the services carried by campus cards have been widely used in universities. In addition to the recharge function, the deposit machine also has services such as payment for campus projects, modification of inquiry passwords and consumption passwords, and query of flow records. In theory, the storage function can greatly facilitate campus life services. However, from the existing research at home and abroad, designers and developers lack communication with campus users. The design study of the transfer machine is based on the developer's ideas, service needs provided by school administrators, batch design study on the transfer machines of major campuses, focus on the implementation of functional technology, but neglect the high availability of the service itself, resulting in many use problems of campus services. The storage machine is a self-service technology terminal, but the nature of its hosting is service[1],the level of usability will directly affect the user's campus life experience and service satisfaction. Today's convenient recharge function is not enough to meet all kinds of necessary campus services carried by campus card. The prompt information on the transfer machine is missing, the hierarchical structure is confusing, and the interface design is stiff, those problems are obvious. Under the situation of increasing user demand and poor service quality of public self-service, the increasingly prominent issue of the availability of self-service for the deposit machine and the urgent need for a large number of campus users are the reasons of this article.

II. BLUEPRINT ANALYSIS OF THE TRANSFER MACHINE SERVICE OF SOUTH CHINA UNIVERSITY OF TECHNOLOGY

The campus card storage service is an experience process for recharging, reporting, and payment for the life and study of teachers and students[2],systematically present service processes to teachers and students, will help its fast and comprehensive understanding of the content and process of the service. The business covered by the depositor is relatively wide, in this study, the participation process of 20 users was observed by participating in the observation method, and during the peak and off-peak periods, record video observations, record duration, and analyze user behavior, construction of service blueprint for the card storage in the campus of South China University of Technology[3],the service process is divided into four phases according to the operation duration, each stage is based on the structure of the interaction line, visual line and internal interaction line of the service blueprint, break down its content into 7 elements of metrics, physical evidence, user activity, service providers, digital devices, back-office and support systems[4].The blueprint for the transfer machine service on the campus of South China University of Technology is shown in Figure 1. The dotted line is used to express the possible service behavior.

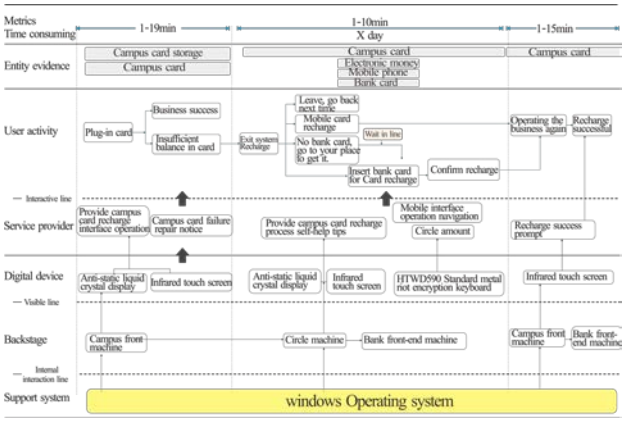

Fig1. South China University of Technology campus card storage service blueprint

Through the analysis of the service blueprint of the above figure, the process of the card transfer service of the campus card of South China University of Technology is completely combed. From the metrics in the service blueprint, we can analyze the time-consuming uncertainty caused by the peak queue length of the campus storage machine in South China University of Technology, the length of time required to handle the cardholder business, and the delay of information contact, it provides an analysis basis and direction for the research experiments on the availability of the next transfer machine service.

III. PCAMPUS CARD STORAGE SERVICE AVAILABILITY MEASUREMENT

Through the analysis of the above service blueprint, the logic and content of the "touch point" in the user activity will be the focus of the service usability test elements of the transfer machine.

A. Test index

ISO 9241-11International standards defined usability as follows: the effectiveness, efficiency, and subjective user satisfaction of a product for a specific use in a particular use environment[5]. The usability test indicators are shown in Table I.

TABLE I. USABILITY TEST INDICATOR

Effectiveness	Efficiency	Satisfaction
Task completion rate: This is divided into three dimensions: "no error, independent completion,self-inflicted but completed independently,completed with the help of the moderator" to assess the effective completion of the tester.	Mission success rate/task time	For the rating scale of the system's use satisfaction, all items of the scale use 5 points from 'strongly disagree' to 'strongly agree'. The user's final answer will be converted to a one-digit score.
Error frequency: Invalid clicks (times), the number of screen invalid clicks by the tester during the test.	Record error: the tester's mistakes during the test	
Seek help frequency: The number of times the tester asks the host for help when completing the task.		

B. Test method and content

This test is a typical task-based test, using collaborative cooperation, vocal thinking and retrospective testing; randomly invited 20 campus users as a sample of the service availability measurement of the South China University of Technology campus card storage machine, completed Two tasks in a given scenario[6],The task is based on the 149 valid questionnaires, except for the one-card recharge service, the user uses the two campus services with the highest frequency of the deposit machine to simulate the scene, as shown in Figure 2, respectively 1.Use the campus card transfer machine to recharge the network fee, recharge the network fee for one month, and tell the feelings of the heart while carrying out the task (using the sound thinking method here) ; 2.Recharge the air-conditioning fee with the campus card transfer machine, recharge 1 yuan, and tell the feelings of the heart while carrying out the task. Record the test process, which uses a collaborative approach that allows users to ask when they don't know what to do, count the frequency of the users being tested for help. The user usability test is shown in Figure 3. After the test, let 20 users fill in the usability questionnaire to evaluate the satisfaction of the transfer machine service, and measure the availability of the task for quantitative analysis. Then use the retrospective test method to post and collate the video data of 20 users, record the task completion rate, error frequency and help frequency, and evaluate the validity of the service of the depositor; Finally, the service efficiency of the transfer machine is evaluated by the task success rate/task time.

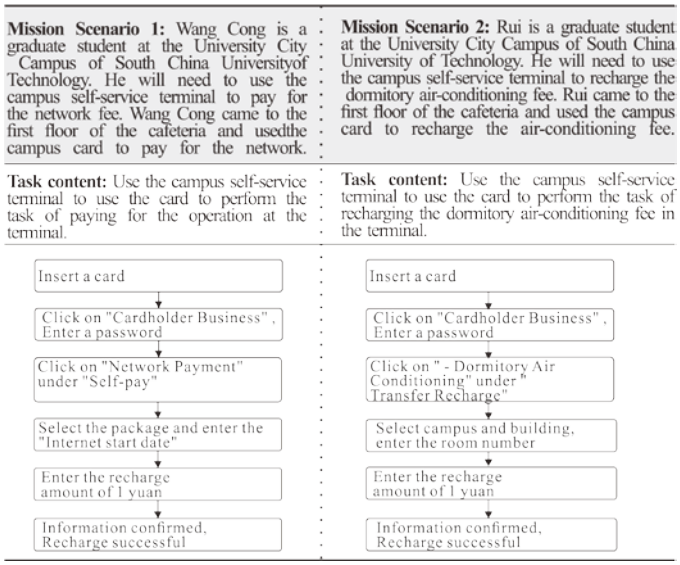

Fig.2 Task scenario

Fig.3 Sample usability test

C. Test Results

The specific test indicators of the service availability of the transfer machine are as follows:

1) Poor effectiveness: Through the statistics of two tasks of 20 samples, the task completion rate is as follows:2 users successfully completed the task one,1 user successfully completed task 2,1 user completed two tasks with the help of the moderator; the rest of the users were both overwhelmed but completed two tasks independently. Therefore, the data is visualized from the three dimensions of "invalid clicks, whether you are overwhelmed and the number of inquiries", see Figure 4,the number of queries of the tested users is small, some users will ask the host's date when they need to enter the time, but the number of invalid clicks during the user test and the user's experience are overwhelmed.

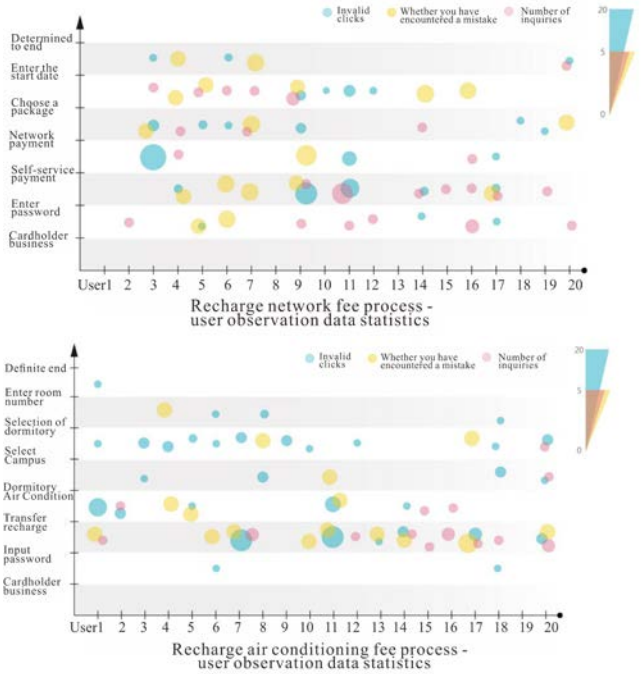

Fig.4 Sample test validity statistics

2) Low efficiency: The test user's operation errors counted in this test include: the subconscious point return button, causing the login to exit, and wanting to press return but exit directly to the home page, the operation before restarting, the wrong date, the password input error, forgetting to be a few passwords, etc. Eight of the 20 users tested had operational errors, and the ratio is already high.

3) Low user satisfaction: 20 users who completed the task fill out the SUS usability questionnaire. SUS(System Usability Scale)system availability scale is calculated as:[Σ(Positive description score -1)+Σ(5-Negative description score)]*2.5,the scale consists of 10 questions.The overall reliability of SUS is 0.92,the reliability of the usability project is 0.91.See Table II,10 items of the scale, all items adopt 5 points from “strongly oppose” to “strongly agree”.Before the questionnaire, it is guaranteed that each sample has completed the tasks in the given scenario,according to the user's most intuitive feelings, fill out the questionnaire, and finally get the statistics results,see table III.

TABLE II. SUS AVAILABILITY SCALE QUESTIONNAIRE

	Item	✖[a]	×[b]	□[c]	○[d]	●[e]
1	I think I will be willing to use this system frequently	1	2	3	4	5
2	I found that this system does not need to be so complicated	1	2	3	4	5
3	I think the system is easy to operate	1	2	3	4	5
4	I think the smooth use of this system requires the help of others	1	2	3	4	5
5	I found that the different functions in this system are better integrated	1	2	3	4	5
6	I think this system has too many inconsistencies	1	2	3	4	5
7	I think most people can quickly learn to use this system	1	2	3	4	5
8	I found this system to be very troublesome to use	1	2	3	4	5
9	I feel confident about using this system	1	2	3	4	5
10	In order to operate this system, I have to learn something extra	1	2	3	4	5

[a] Strongly Disagree
[b] Disagree
[c] General
[d] Agree
[e] Strongly Agree

TABLE III. SUS STATISTICS

PARTI-CIPAT	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	SUS SCORE
P1	1	4	3	4	4	5	3	4	2	3	32.5
P2	5	4	1	4	2	3	3	5	3	3	37.5
P3	2	4	2	2	2	4	3	5	2	3	32.5
P4	4	5	2	4	2	4	3	4	2	2	35
P5	3	3	2	3	2	5	3	4	2	3	35
P6	1	4	3	2	2	4	1	5	2	3	27.5
P7	1	3	1	4	2	5	2	5	2	2	22.5
P8	4	3	2	5	2	3	3	4	2	5	32.5
P9	2	5	1	3	1	4	2	5	3	3	22.5
P10	1	5	1	4	2	4	1	5	1	5	7.5
P11	5	5	1	4	1	3	2	4	3	2	35
P12	2	5	1	4	1	5	3	5	1	4	12.5
P13	3	5	2	3	3	3	2	3	2	3	37.5
P14	2	5	1	2	1	5	4	5	1	4	20
P15	2	3	1	4	2	5	2	5	1	5	15
P16	2	4	2	4	3	3	1	5	2	4	25
P17	3	5	2	5	4	5	2	5	2	3	25
P18	1	5	1	4	2	4	3	5	2	4	17.5
P19	2	4	1	3	2	5	1	5	3	3	22.5
P20	2	5	1	3	1	5	2	5	2	3	17.5
AVERAGE						25.625					

From table III, we have obtained the availability score of 25.625 for the transfer machine in South China

University of Technology. Bangor, Kortum, and Miller (2009)by evaluating the correlation between the SUS score and a 7-point adjective, the SUS score is divided into five levels from F(<60)-A(>90).[7-8]See Table IV, you can convert the original score into a percentage level, essentially, the percentile level is used to indicate how much your application is available relative to other products in the total database. The availability score for this experiment is shown in table IV as its corresponding rating is F, corresponding to a percentile of 0-14,It can be seen that the existing campus card self-service terminal has low service flow satisfaction, poor usability, and there is room for improvement.

TABLE IV. SUS SCALE

SUS Score Range	Grade	Percentile Range
84.1-100	A+	96-100
80.8-84	A	90-95
78.9-80.7	A-	85-89
77.2-78.8	B+	80-84
74.1-77.1	B	70-79
72.6-74	B-	65-69
71.1-72.5	C+	60-64
65-71	C	41-59
62.7-64.9	C-	35-40
51.7-62.6	D	15-34
0-51.7	F	0-14

D. Result analysis

Ten usability heuristic evaluation principles proposed by usability engineering expert Jakob Nielsen[9],through the results of the service availability test of the deposit machine, it can be analyzed that the service design of the transfer machine violates the following principles.

1) Clear logo exit principle: The “Back” function key of the interface is located in the lower right corner of the interface, and the “OK” function key is located in the lower left corner,the user habitually clicks on the bottom right corner and mistakes the “OK” function key, causing the user's wrong operation. At the same time, the definitions of “return” and “exit” are unknown. The user clicks “return” to return to the previous level, but directly leads to logout.

2) Error prevention principle: When the user enters the password in the login account, the password will be entered incorrectly, because there is no prompt to tell the length of the password. This is the error prevention that can be prompted by the message.At the same time, users need to fill in the date when they pay the network fee payment service,However, there is no date of the day on the interface, which may cause the user to enter the wrong date and perform the wrong operation.

3) Use the user's language principles: When the user is doing the operation of air-conditioning fee recharge and network fee payment, they do not know how to find the service entrance,the interface function area is divided between “recharge transfer” and “self-pay”, which is an unclear language cognition, it makes the number of invalid clicks on the screen increased and the efficiency is low.

*4)Beautiful and simple design principles:*The layout of the storage machine interface is too rigid and not close to the campus atmosphere,at the same time, the function buttons that the user needs to click are small, which makes it difficult for the users to make precise selections,the first visual impression of an unattractive interface directly affects user satisfaction.

IV. USABILITY IMPROVEMENT DESIGN AND COMPARATIVE ANALYSIS

Based on the above case study, the overall interface characteristics of the interface need to be improved, and the interface style design should trend to be younger. The division of functional areas needs to follow the “user-centric” principle, and the user's frequently used service function keys are preferentially displayed, unify the two functions of “self-paying” and “transfer recharge”, which are easy to confuse users, into the “recharge payment” function, to avoid time-consuming memory and function search, “Return” and “Exit” are refined to “return to the previous level” and “exit login”, and the “OK” function key is highlighted in the lower right corner of the interface that most users are accustomed to click. And prioritize the information display by rationalizing the survey of user habits, air-conditioning fee recharge and network fee payment priority are placed in the lower level of “recharge and payment” function key, reasonable adjustment of the user needs to click on the selected function key shape to reduce the number of invalid clicks and missed clicks, reduce the time-consuming task of executing instructions, and improve the design usability. Before and after redesign, see Figure 5.

Fig.5 Comparison before and after design

After redesigning, experiment After redesigning, let the user complete the same two tasks as the first time, conduct a comparative test, and analyze the time taken by the user to perform the task, as shown in Figure 6,the time spent on the second test is significantly lower than the first test, and the service efficiency is greatly improved on the premise of completing the task. The same statistics include the number of invalid clicks and the number of times users sought help, and the data indicates that they have all improved significantly.

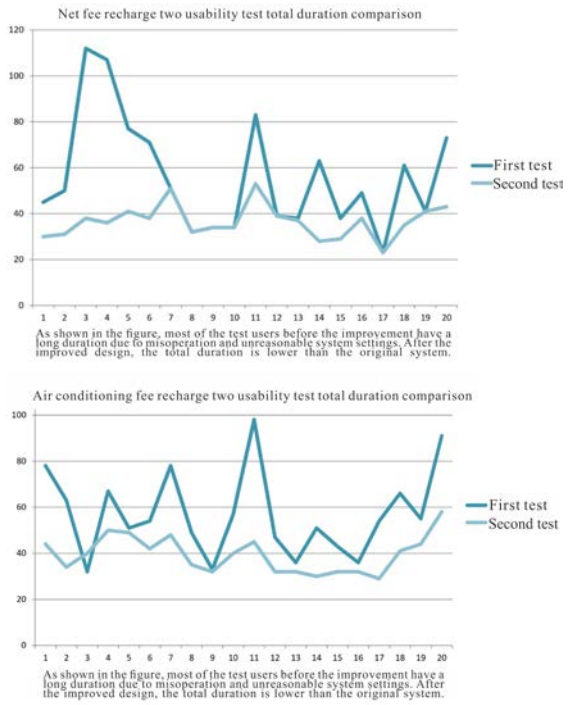

Fig.6 Time-consuming comparison of user execution tasks before and after design

V. USABILITY IMPROVEMENT DESIGN AND COMPARATIVE ANALYSIS

User behavior research prior to functional classification. Students, teachers, staff, teaching assistants, and workers are the main user groups of the transfer machine. In the design optimization of the transfer machine, it is very necessary to invite a diverse number of novice users, schools and engineering personnel to conduct design research together, consider the user's behavior logic first, as the starting point of the interface design, and then implement the technology from the functional logic. Consider the user's scenario and purpose: when the user pays the network fee during the peak period of the queue, insufficient balance is displayed when the last step is paid, users will worry that people waiting in line will wait too long, in this scenario, the user will feel anxious and even give up the service halfway, therefore, the design needs to have an automatic display of the balance before the user pays the fee, avoiding unnecessary operation and time consuming. Design needs to truly stand on the user's stand, understand the user's mentality and requirements in different situations[10]. In the situation of the common platform of the transfer machine and the Internet, use the Internet channel WeChat, Weibo, Zhihu or short video, etc, through “Big Data” to scientifically and accurately collect and organize users' attitudes and expectations on campus card service, more accurate service design. Service design that is not based on user’s needs is of little significance and will soon be eliminated by users. The service design of the transfer machine should truly serve the people, create easy to use, useful and hopeful services for the customers, create effective, efficient and distinctive services for the organization, thus creating a better experience and delivering more positive value[11].

Timely information architecture matching under changing demand. The storage machine is lack of competition in terms of the application scenario of the campus. The small competition scene is likely to cause product design lag [12]. The existing popular storage mechanism has similar functions, no innovation, but the user's demand is constantly Land changes, resulting in its service availability has been declining over time, such as the bank card recharge method previously designed by the deposit machine. With the development of electronic transfer payment, users are more inclined to mobile payment or Alipay, WeChat scan code recharge, and faster It can increase user stickiness. Businesses also need to start thinking about whether the storage machine will be replaced by mobile services in the future. Mining user needs of this large group of campus users. How to accurately grasp the mobile service design trend is worth considering.

VI. CONCLUSION

This study takes South China University of Technology as an example to scientifically and accurately analyze the issues related to the availability of campus card storage self-service, and summarizes and sorts out. The purpose is to provide better self-service for the majority of campus users, to find direction and coordinates for further design activities, and to promote the investment and development of self-service technology in the business context. From the user's point of view, users get better and more efficient self-service; from the perspective of service providers, design researchers can accurately and accurately provide campus users by analyzing and researching the actual needs of users. Timely service, improve user's stickiness to service and enhance its core competitiveness; from the perspective of social value, it can promote the popularization and application of social self-help technology, make the big data era better serve the society, optimize users and service provision The relationship between the people creates a more harmonious social atmosphere.

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