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A Study of Library Window Seat Consumption and Learning Efficiency Based on the ABC Attitude Model and the Proposal of a Library Service Optimization Strategy

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Abstract: The aim of this study is to determine the relationship between occupants' emotional attitude, decision behavior, and environmental cognition toward window seats and learning efficiency and the mechanism of this relationship in public spaces (represented by academic libraries). Surveys were delivered to the academic library of Shanghai Jiao Tong University. A total of 280 valid face-to-face interview questionnaires was collected and analyzed for correlation and validation of theoretical models. The results show that learning experience, as a mediator of learning efficiency, has a significant impact on the model of occupants' attitude toward window seat consumption. The impact mechanism was determined, and it indicated that in order to improve the learning efficiency of occupants, indoor re-planning should be carried out to improve the seat satisfaction and occupancy rate. This study introduces the concepts of service design and architectural consumption and constructs an occupant emotional consumption context with the window seat as the consumption product. In addition, it also has guiding value for seat reallocation in public buildings in the COVID-19 era. This theoretical framework provides a direction for the simulation of future construction consumption behavior.

Keywords: seat preference; seat occupancy; model of consumer behavior; service design

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1. Introduction

The human pursuit for a better life and the development of architectural research have resulted in a variety of building types, such as office buildings, classrooms, engine rooms, shopping centers, etc., thus reflecting the rich diversity of architecture. Scholars of the built environment carry out various related works to promote research on the interaction and relationship among engineering performance of the building itself. As Shown in Figure 1, the satisfaction of the occupants of the building, and the environment in which the building is located [1].

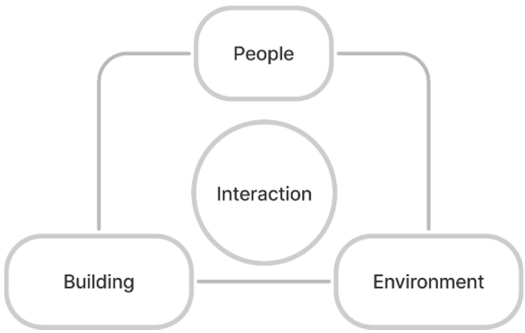

Figure 1. The interaction of people, buildings, and the environment.

In order to describe the complex relationship among people, buildings, and environments, scholars have gradually improved built environment assessments [2] and incor-

porated them into a unified system. From the perspective of architecture, some scholars have expanded the characteristics of different types of buildings and have studied indoor environmental parameters through engineering simulation methods, that is, they have studied the characteristics of buildings themselves in order to achieve better performance and well-being of residents [3]. In addition, some scholars have conducted behavioral simulations [4] and research of subjective factors [5] from the perspective of human beings. Among many research objects, the importance of academic public spaces such as libraries has not been explored. Moreover, studies on occupants tend to regard people as rational engineering people [6] rather than as individuals with emotional dependence.

This study points out that in the special context of the library, the centralized heating, ventilation, air-conditioning, and cooling (HVAC) control system is generally adopted in the public building environment [7], and the active interaction path between occupants and the building environment is actually lacking. Occupants cannot intervene whether indoor environmental parameters serve them or not. At the same time, after post-occupancy evaluation (POE), it is difficult to change the artistic structure and functional design of such buildings [8]. In this context, this study regards the user participation variable in such public buildings represented by libraries as a kind of consumption behavior occurring in the building space [9]. This consumption behavior refers to the occupying behavior of library users for seats. As a service provider, the library provides a service product that means "seat" [10].

In this consumption situation, occupants' interactions with the library are amplified, and subjective interaction demands are generated. Based on the ABC attitude model (a theoretical model of consumer behavior composed of attitude, behavioral tendency, and cognition), this study proposes a theoretical model of consumption behavior, namely, the relationship between consumption attitude, cognition, and behavior. At the same time, we point out that if the user's interaction with any different type of building is placed in the context of consumption behavior, the user's satisfaction and well-being regarding the building are ultimately reflected in the user's evaluation of the experience achieved through the implementation of the consumption behavior. For example, the consumption behavior of the employees in an office building is working, the consumption behavior of passengers in an airplane cabin is taking the plane, and the consumption behavior of students in a classroom is learning. Their satisfaction with space consumption behavior is reflected in office experience, travel experience, and learning experience. These experiences ultimately affect the user's behavior in the building, such as efficiency.

Based on the above definitions, we put forward a theoretical framework to study the final relationship between the consumption attitude model of library window seat selection and learning efficiency [11]. Based on the concept of service design and consumer behavior, this study combines architectural consumption behavior, which can help us better understand the emotional and behavioral patterns of complex individuals with perceptual thinking. This study focuses on proposing strategies for interior planning and layout design, so as to improve the occupancy rate of interior areas and the overall well-being of users in the building. It also has guiding value for the seat redistribution of public buildings in the era of COVID-19. At the same time, this theoretical framework provides a simulation idea for the simulation of user behavior in buildings, which will help in the development of future work.

2. Literature Review and Hypothesis Development

2.1. Building Environmental Assessment, Interior Layout Design, and Satisfaction

Excellent architectural performance is not only reflected in the reduction of building energy consumption, but also in the pursuit of the well-being of the people in the building [12]. Through building evaluation, the objective description of the building and the subjective satisfaction of indoor experience can be studied.

Post-occupancy evaluation (POE) [13] not only focuses on issues related to building functionality and energy efficiency performance, but also on the subjective feelings of

occupants and indoor environmental quality (IEQ). The evaluation of subjective feelings is related to occupant perception and objective factors, reflecting the user's subjective satisfaction [11]. At the same time, there are many factors that affect users' subjective perceptions, including gender, age, education background, attitude, cognition, and so on [14]. IEQ is a description of the physical environmental parameters in a building, including thermal comfort, visual comfort, indoor air quality, acoustic comfort, etc. [15]. These parameters tend to show different degrees of importance for different buildings, and also reflect the influence of the user's behavioral experiences in the building. The study of thermal comfort plays an important role in building environment satisfaction [16]. Visual comfort and sound comfort also show an impact on satisfaction [17]. It is worth clarifying that all these factors affect the occupants' performance in the building to varying degrees. Especially for education and office buildings, more attention is paid to improving occupant performance by providing good indoor environmental parameters. Poor IEQ in schools can lead to sickness and absences, as well as adverse health symptoms and lower academic performance [18].

Actively carrying out the above post-check-in evaluation is of guiding significance to the interior design of the building, and interior design will also affect the emotional state, behavior performance, and satisfaction of the occupants [19], such as space size, shape [20], interior color [21], design style, etc. [19]. The interior design of buildings with different functions shows the significance of the specific context. Effective learning environmental design can enhance students' positive emotions [22]. Appropriate retail environments can promote consumers' desires to buy [23].

This study holds that the relationship between the occupant and the building is a kind of consumer and consumption service carrier [24]. Consumers have different consumption behaviors for different building types, and the final satisfaction of the building is related to the experience caused by the aim of specific consumer behavior [25].

Because different types of buildings have different functions, and consumers will show different consumption behaviors in, for example, office buildings, shopping centers, airports spaces, etc., user satisfaction with space is separately reflected in the work experience, shopping experience, and flight experience, respectively. These different types of experiences have an impact on the performance and efficiency of consumers.

Although some scholars have carried out studies with libraries as the carriers [14,26,27], there is a lack of research dominated by spatial consumption behavior.

This study argues that library users engage in consumption behavior toward the library, and the ultimate satisfaction of this behavior is represented as learning experience, and learning experience affects learning efficiency.

First, we propose the following hypothesis:

Hypothesis 1 (H1). *The learning experience of library users is positively correlated with learning efficiency.*

2.2. Seat Preferences and Satisfaction

For academic public space, there are many factors that will affect student behavior in the building, such as learning habits, individual differences, seat position, and so on [27]. Among these variables, seat position has been shown to have a significant impact on academic performance [28]. Shernoff used data analysis to study the effect of seat placement on student engagement and performance [29]. At the same time, personal preferences for seat location is also influenced by various factors such as scenery, lighting, windows, etc. In one university library in Australia, outdoor views were shown to have a significant impact on seating preferences [30]. Research on the relationship between lighting and seat preference shows the value of meeting students' needs and providing them with preferred seating [31]. Totusek divided students' personalities through questionnaire surveys and studied the correlation between preference choices and personality factors [32].

Many scholars have studied the efficiency improvement brought by seat selection from the perspective of academic factors, demographic factors, and spatial factors [33]. Some of these preference choices emphasize the importance of the visual environment as a preference. Related to this, preference for seats near windows has been confirmed [34], and proximity to windows improves learning experiences and physical and mental health. Achoba conducted a study of 267 respondents to show the interrelation between seating arrangements and windows to plan for more rational relationships and assignments [11].

The seating preferences studied by scholars, though, are portrayed as a rather complex phenomenon [35]. However, in the context of a specific building, this seating preference can be regarded as the correlation between multiple external factors and user behaviors and mentalities, and the user-centered architectural context provides constraints for external factors.

This study holds that when the library consumer performs the consumption behavior, this behavior actually acts on the consumption product provided by the library, namely, the seat [36]. The difference of the seat caused by the influence of the indoor environment and interior design mentioned above represents the impact of the satisfaction with the final consumption behavior [37], that is, the learning experience. Here, according to the actual context of the research carrier, Shanghai Jiao Tong University, the consumption difference is set as whether the seat is near the window.

Therefore, the further hypotheses are:

Hypothesis 2a (H2a). *Whether the seat consumed by the window is positively associated with the learning experience of the consumer*.

Hypothesis 2b (H2b). *Whether the seat consumed by the window is positively associated with the learning efficiency of the consumer*.

2.3. Daylight Comfort and Satisfaction

Occupants in space have their own cognition about the visual and thermal performance of the building [38]. Furthermore, as an important factor in visual and thermal perception systems of buildings, the importance of daylight has been reflected in office space, [39], living environments [40], and educational environments [41], but not much in academic space. In addition to interior redesign planning, the improvement of academic public space environments is of great significance for the improvement of visual and thermal comfort [42]. By improving thermal comfort, we can improve our academic performance [43]. For visual environments, light can be divided into artificial light and natural daylight due to the presence of window media. Access through windows with ample daylight and external views is actually beneficial to the occupants and will affect their satisfaction with the workspace [44].

A study showed that students in natural daylight and mixed lighting rooms showed higher concentration than those in rooms with artificial lighting [45]. In the classroom, children who lack natural lighting behave significantly differently [46]. For the subjective choice of users, library users will prefer seats near the daylight area [47]. Lighting in this area is coordinated with visual comfort, measuring both the user and the building through environmental processes [48].

We proposed that spatial consumers will have their own consumption attitudes towards the environmental factors related to the consumption products when they perform their consumption behaviors [49]. These attitudes influence the satisfaction of consumer behavior (learning experience). In this study, the visual and thermal factors carried by the seat, which is a consumer product, are distinguished on the basis of the attributes of being near the window, visual and thermal experiences are brought by outdoor lighting, and the visual and thermal experiences are brought by the indoor HVAC system and the lighting system.

The following research hypotheses are put forward:

Hypothesis 3a (H3a). *Visual experience brought by indoor lighting is positively associated with learning experience.*

Hypothesis 3b (H3b). *Visual experience brought by outdoor lighting is positively associated with learning experience.*

Hypothesis 3c (H3c). *Thermal experience brought by the indoor environment is positively associated with learning experience.*

Hypothesis 3d (H3d). *Thermal experience brought by outdoor sunlight is positively associated with learning experience.*

Hypothesis 4a (H4a). *Visual experience brought by indoor lighting is positively associated with learning efficiency.*

Hypothesis 4b (H4b). *Visual experience brought by outdoor lighting is positively associated with learning efficiency.*

Hypothesis 4c (H4c). *Thermal experience brought by the indoor environment is positively associated with learning efficiency.*

Hypothesis 4d (H4d). *Thermal experience brought by outdoor sunlight is positively associated with learning efficiency.*

2.4. Expectations and Satisfaction

As a user's subjective emotional response, satisfaction is not only related to the objective performance of the object but also to the user's own psychological behavior [50]. The expectation of objective performance affects the user's perception of satisfaction. This expectation of objective factors includes interior environmental parameters and interior design layout. Most occupants have their own sense of expectations about the interior environment itself when entering a building [51,52]. In an indoor airplane environment, the higher the subjective expectations, the lower the comfort level of the cabin climate [53]. In for-profit buildings, the expectation of interior design is satisfied, and it is easy to stimulate occupants' consumption behavior so as to further improve their satisfaction [54].

This expectation provides us with an idea to view the problems related to the built environment from an engineering discussion to behavior management [55]. This study believes that the consumption behavior of consumers of buildings is also influenced by their consumption attitude, that is, their inner expectation for the attributes attached to the consumption seat. Here, the consumption attitude is expressed as the user's preference degree for the factor of a seat by a window, which is related to the satisfaction (learning experience) of the consumer.

The following hypotheses are put forward:

Hypothesis 5a (H5a). *Consumers' preferences for seats by windows is positively associated with learning experience.*

Hypothesis 5b (H5b). *Consumers' preferences for seats by windows is positively associated with learning efficiency.*

2.5. Research Objectives and Theoretical Model

This study aims to study the correlation between occupants' consumption behaviors of library window seats and learning efficiency. We propose a special consumption context based on the library (as shown in Figure 2). In this context, we regard library users as consumers, and the library provides consumers with consumption places. It is different from the consumption carrier function presented by for-profit commercial buildings, as

this study takes the library of Shanghai Jiao Tong University as the research carrier to make a more suitable context explanation for the library:

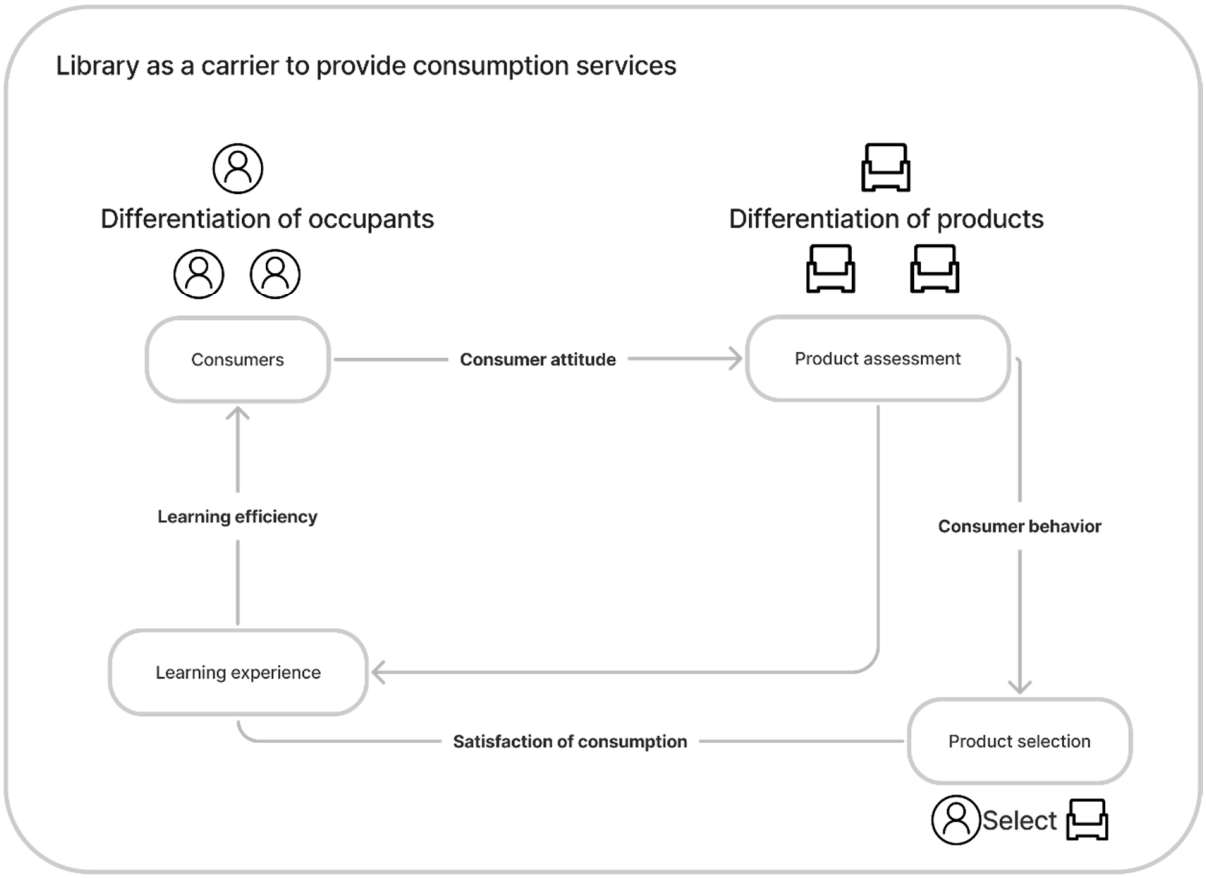

Figure 2. The relationship between people and libraries in the context of consumption.

First, for the public teaching building, taking the library as an example, functions related to indoor environment quality regulation are subject to a centralized HVAC system and unified regulation. Individual consumers are unable to raise dissatisfaction and make appeals take effect immediately.

Secondly, in the relatively stable indoor quality environment, mainly academic libraries, consumers' consumption behaviors are reflected in the choices of seats in the library. This consumption behavior reflects consumers' consumption attitudes, which are subjected to the common constraints of consumer inner expectations and external limitations and that finally determine the satisfaction of this consumption.

This also means that the library, as the provider of consumer services, needs to consider the perspective of service design [45] and improve the service process so as to improve consumers' scoring of consumption experience [46]. Therefore, it is necessary to understand the relationship between consumer behaviors and put forward reasonable strategies to reconstruct the interior layout so as to achieve the overall satisfaction for the purpose of providing seat services [47].

Many studies have used different behavioral theoretical models [56,57], and the relevant theoretical models of behavioral research have been tried to be used in architectural evaluation, and progress has been made [58]. The ABC attitude model points out that attitude is the combination of cognition, emotion, and behavior [59], and this model theory has been applied in various fields [60].

However, it is rarely used in architectural appraisal, because architectural appraisal rarely triggers the view of the interaction between people and buildings from the perspective of consumers. Unlike the hypothesis of the rational person [61], this model highlights

the important role of emotional response in decision making, which can help us sort out the user journey map and explore the formation path of consumption behavior [62].

Therefore, we made the following improvements based on the theoretical model of ABC attitude:

1. In the cognitive stage, it has been confirmed that the evaluation of the visual and thermal environment has an impact on satisfaction. In this study, the cognitive attitude was tested by the satisfaction with the visual and thermal experience brought by indoor and outdoor light and heat.
2. In the attitude stage, there are significant differences among occupant consumers. In this paper, consumer affection and satisfaction with the window seat were used to show their emotional attitude.
3. In the behavioral stage, consumers' behavioral intentions are related to their actual behavior [56] but are limited by actual environmental factors, such as library interior design layout and window seats, and there is the possibility of a mismatch between behavioral intention and actual behavior. To sum up, this study constructed a conceptual model, as shown in Figure 3, to explain consumption behavior based on the ABC attitude model, aiming to verify whether the consumption behavior path of consumers for window seats in the context of academic libraries affects learning efficiency. According to the behavior model and service design concept, a complete design strategy is put forward to guide the interior layout design through the associated study of library seat occupancy [63] so as to improve the overall well-being of occupants and increase learning efficiency.

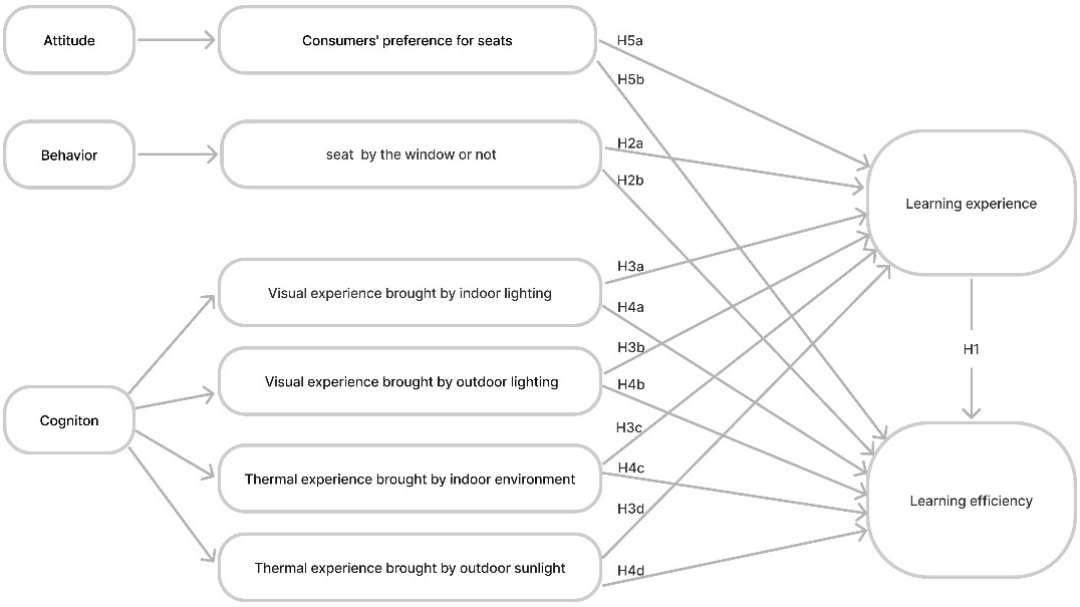

Figure 3. The conceptual model of the consumption behavior of library window seats.

3. Methodology

3.1. Sample and Data Collection

In this study, the library of Shanghai Jiao Tong University was selected as the distribution place of samples. The characteristics of the library are as follows: (1) People who come and go to the library have the same background, which are teachers and students of this school. (2) The library is not only a place for reading books, but also an academic place where users can study and work for a long time. (3) The HVAC system of the library is centrally controlled, and people can only accept the indoor environmental feeling.

Firstly, pre-sampling was performed to accomplish three considerations: (1) From the statistical analysis of the respondents' gender, grade, time to the library, and study time in the library, the differences among the interviewed samples were not significant, which

could reflect the overall situation of the library users. (2) We ensured the seat consumption behavior of the samples. The analysis showed that the main reasons for the sample group to choose seats were lighting and scenery, which also promoted the highest seat intention choice rate in the area near the window. (3) The propensity selection of each area of the library seats was evaluated.

At the same time, the information presented by the pre-study samples showed that: (1) The ratio of male to female was 3:2; (2) 41.1% of the users came to the library 3–5 times a week, and 38.36% of the users came almost every day; (3) In terms of grade distribution, users were mainly concentrated in the undergraduate category; (4) 69.86% of users arrived at the library in the morning; (5) 65.75% of the students studies in the library for more than or equal to 5 h each time. These points indicated that the research samples were representative of the consumption behavior of library users in this environment, and the interference of the mentality of choosing a seat for the first time on the consumption behavior was excluded.

Finally, we conducted a formal questionnaire survey based on the above information. In total, 315 questionnaires were distributed, 298 were effectively recovered, and the remaining 280 valid samples were screened for analysis.

3.2. Variable Measurement

The observation variables designed in this questionnaire were based on literature, measured by the Likert method, and the basic information of users was collected at the same time. Through literature reference, the designed questionnaire was changed into Chinese ideographs that were easy to understand for sampling. The contents of the questionnaire are shown in Appendix A.

The cognitive part included an assessment of environmental experience. The experience problems caused by different indoor and outdoor light sources and heat sources were based on the IOS 10551 standard [64] and the related comfort research questionnaire [65]. In the behavioral part, the question about whether the selected seat is the window seat was based on Yildirim's research [44]. In the attitude part, the question about the degree of preferring the seat near the window referred to Othman's research on the satisfaction of public library readers [47]. Questions on learning experience and learning efficiency were set in reference to Alena's research questionnaire on individual performance [66].

3.3. Analysis Process

All sample data were collected through face-to-face surveys and analyzed using SPSS26.0. First, Pearson's correlation coefficient was used to test the correlation, and then the regression analysis was carried out according to the theoretical model.

4. Results

4.1. Analysis of Correlation

As shown in Table 1, Pearson's coefficient was used for correlation analysis, which reported the means, standard deviations, and correlations between variables examined in this study. Intercorrelations of all variables were investigated to determine if variables were significantly related.

The results indicated the following: Q1: "Is the seat by the window?" ($r = -0.200$, $p < 0.01$), Q3: "Visual experience brought by indoor lighting" ($r = 0.436$, $p < 0.01$), Q4: "Visual experience brought by outdoor lighting" ($r = 0.473$, $p < 0.01$), Q5: "Thermal experience brought by indoor environment" ($r = 0.327$, $p < 0.01$), Q6: "Thermal experience brought by outdoor sunlight" ($r = 0.388$, $p < 0.01$), and Q7: "Rate your learning efficiency" ($r = 0.688$, $p < 0.01$) had significantly positive relationships with the performance of Q8: "Rate your library experience".

Table 1. Descriptive statistics and Pearson correlation matrix (N = 280).

	Mean	S.D.	1	2	3	4	5	6	7	8	9	10
1. Is the seat by the window?	0.83	0.381	1									
2. How much do you like window seats?	3.48	1.317	0.209 **	1								
3. Visual experience brought by indoor lighting	3.01	0.956	−0.212 **	0.150 *	1							
4. Visual experience brought by outdoor lighting	2.51	1.009	−0.073	0.174 **	0.444 **	1						
5. Thermal experience brought by indoor environment	3.03	0.925	0.087	0.296 **	0.437 **	0.432 **	1					
6. Thermal experience brought by outdoor sunlight	2.81	0.913	0.020	0.244 **	0.360 **	0.544 **	0.551 **	1				
7. Learning efficiency	1.17	1.284	−0.151 *	0.170 **	0.261 **	0.319 **	0.198 **	0.306 **	1			
8. Learning experience	1.40	1.202	−0.200 **	0.152 *	0.436 **	0.473 **	0.327 **	0.388 **	0.688 **	1		
9. Gender	0.54	0.499	0.140 *	−0.031	−0.132 *	−0.054	−0.061	−0.047	−0.050	−0.113	1	
10. Education degree	0.31	0.473	0.108	0.237 **	−0.047	−0.032	0.034	0.061	−0.036	−0.025	−0.037	1

Notes: ** $p < 0.01$, * $p < 0.05$.

4.2. Hypothesis Testing

We tested our hypotheses using nine regression models, the results of which are reported in Tables 2 and 3.

Table 2. Results of regression analyses (N = 280).

Variables	Model 1	Model 2	Model 3	Model 4
Gender	−0.274 $^{+}$ (0.058)	−0.274 $^{+}$ (0.058)	−0.265 * (0.064)	−0.139 (0.258)
Education degree	−0.073 (0.631)	−0.073 (0.631)	−0.172 (0.266)	−0.038 (0.766)
Is the seat by the window		−0.592 ** (0.002)		
How much do you like window seats?			0.151 ** (0.007)	
Visual experience brought by indoor lighting				0.310 *** (0.000)
Visual experience brought by outdoor lighting:				0.309 ***(0.000)
Thermal experience brought by indoor environment:				0.030 (0.720)
Thermal experience brought by outdoor sunlight:				0.176 * (0.045)
Rate your learning efficiency				
Rate your library experience				
R^2	0.014	0.048	0.039	0.305
F value	1.897	9.849	7.396	28.590

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $^{+}$ $p < 0.1$.

Table 3. Results of regression analyses (N = 280).

Variables	Model 5	Model 6	Model 7	Model 8	Model 9
Gender	−0.274 $^{+}$ (0.058)	−0.078 (0.615)	−0.121 (0.428)	−0.046 (0.752)	0.070 (0.534)
Education degree	−0.073 (0.631)	−0.058 (0.720)	−0.224 (0.177)	−0.095 (0.536)	−0.049 (0.681)
Is the seat by the window		−0.487 * (0.017)			
How much do you like window seats?			0.183 ** (0.002)		
Visual experience brought by indoor lighting				0.173 $^{+}$ (0.053)	
Visual experience brought by outdoor lighting:				0.222 * (0.015)	
Thermal experience brought by indoor environment:				−0.050 (0.610)	
Thermal experience brought by outdoor sunlight:				0.261 * (0.013)	
Rate your learning efficiency					
Rate your library experience					0.737 *** (0.000)
R^2	0.004	0.024	0.037	0.141	0.474
F value	0.542	5.718	9.568	10.904	246.551

Notes: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, $^{+}$ $p < 0.1$.

Table 2 contains Model 1 to Model 4 with "Learning experience" as the dependent variable. Model 1 was the baseline model, which explained 4.8% of the variance. Model 2 tested the behavior effect, namely, the relationship between Q1: "Is the seat by the window?" and "Learning experience". Hypothesis 2a states that whether the seat consumed is by the window is positively associated with the learning experience of the consumer. In Model 2, we added the Q1: "Is the seat by the window?" variable to the equation and tested its relative contribution to the variance in the dependent variable. With respect to "Learning experience" in Model 1, Q1 increased the variance explained by 3.4%. The coefficient for Q1

was significant at the 0.001 level with b equal to −0.592, which was a significant correlation; however, it showed an inverse correlation, unlike the positive correlation mentioned in the hypothesis. We conducted post hoc checks on this phenomenon, the results of which are in Section 5. Model 3 tested the attitude effect, namely, the relationship between Q2: "How much do you like window seats?" and "Learning experience". Hypothesis 5a states that consumers' preferences for seats by windows is positively associated with learning experience. Apparently, the coefficient for Q2 was significant at the 0.01 level with b equal to 0.151, supporting Hypothesis 5a.

Model 4 tested the cognition effect to analyze support for Hypotheses 3a–3d. These four hypotheses respectively state that the visual and thermal experience of the interior itself environment and the sunlight brought by the windows are positively associated with learning experience. With respect to "Learning experience" in Model 1, the cognition effect in Model 4 increased the variance explained by 29%. It showed that visual experience brought by indoor lighting (b = 0.310) and visual experience brought by outdoor lighting (b = 0.330) were positively associated with "Learning experience", strongly supporting 3a and 3b. Hypothesis 3d was also verified to be true with b equal to 0.176. Support for Hypothesis 3c was not discovered in Model 4; as for the indoor environment, consumers cannot actively control the temperature, which means that the indoor thermal environment will be stable under the control of a centralized HVAC system after continuous operation, resulting in insignificant regional differences in the indoor thermal environment and reduced thermal performance differences between seats. Overall, all three hypotheses were supported, the exception being Hypothesis 3c. The findings suggest that joint consideration of attitude, behavior, and cognition effects under the consumer model helped reflect the positive impact of the consumption of window seats in the library on the learning experience.

Table 3 shows Models 5 to 9 with "Learning efficiency" as the dependent variable. Model 6 tested the behavior effect, namely, the relationship between Q1: "Is the seat by the window?" and "Learning efficiency". Hypothesis 2b states that whether the seat consumed is by the window is positively associated with learning efficiency of the consumer. The coefficient for Q1 was significant at the 0.001 level, with b equal to −0.487, which showed an inverse correlation. We conducted post hoc checks on this phenomenon, the results of which are in Section 5. Model 7 tested the attitude effect, namely, the relationship between Q2: "How much do you like window seats?" and "Learning efficiency". Hypothesis 5b states that consumers' preference for seats by windows is positively associated with learning efficiency. The coefficient for Q2 was significant at the 0.001 level, with b equal to 0.183, supporting Hypothesis 5b.

Model 8 tested the cognition effect to analyze support for Hypotheses 4a–4d. These four hypotheses respectively state that the visual and thermal experience of the interior itself environment and the sunlight brought by the windows are positively associated with learning efficiency. With respect to "Learning experience" in Model 1, the cognition effect in Model 4 increased the variance explained by 13.7%. It showed that visual experience brought by outdoor lighting (b = 0.222) and thermal experience brought by outdoor sunlight (b = 0.261) were positively associated with learning efficiency, strongly supporting Hypotheses 4b and 4d. Hypothesis 4a was also verified to be true with b equal to 0.173. Support for Hypothesis 4c was not discovered in Model 8, and as for the indoor environment, consumers cannot actively control the temperature, which means that indoor thermal environment will be stable under the control of a centralized HVAC system after continuous operation, resulting in insignificant regional differences in the indoor thermal environment and reduced thermal performance differences between seats.

Model 9 tested the effect: the relationship between "Learning experience" and "Learning efficiency". With respect to "Learning efficiency" in Model 1, "Learning experience" increased the variance explained by 47%. The coefficient for "Learning experience" was significant at the 0.001 level, with b equal to 0.737, strongly supporting Hypothesis 1. Hypothesis 4c was not supported by Model 8; for the same reason regarding the central-

ized HVAC system, our results revealed that joint consideration of attitude, behavior, and cognition effects under the consumer model helped to reflect the positive impact of the consumption of window seats in the library on learning efficiency. Furthermore, Model 4 in Table 2 and Model 8 in Table 3 showed that compared with the explanatory rate of "Learning efficiency" (13%) for the variables related to thermal and visual experiences, the explanatory rate of "Learning experience" (29%) increased for the same variables. This shows that although "Learning experience" was positively correlated with "Learning efficiency", the effect of consumption behavior was more reflected in experience.

5. Post Hoc Checks

In the analysis presented above, one of the independent variables is "Whether the seat is by the window". An inverse correlation was found between "Whether the seat is by the window" and "Learning experience" and "Learning efficiency", which led us to reject Hypotheses 1a and 1b.

This result was contrary to what we thought before the experiment, because another variable, namely, "How much do you like window seats?", was significantly positively correlated with "Learning experience" and "Learning efficiency". To gain deeper insight into the result, we conducted a separate analysis in two visual environment unit settings and examined the interaction of Q1 ("Is the seat by the window?") with Q7 ("Learning efficiency") and Q8 ("Learning experience"). We divided samples into two categories according to the situation mentioned in interview about whether interviewees were suffering from direct sunlight.

The first group contained the samples of the questionnaire filled by students suffering from direct sunlight. The second group contained the rest of the samples. Results of post hoc checks were shown in Tables 4–7. Models 11 and 15 showed that the variable "Is the seat by the window and suffering direct sunlight" was significantly correlated with "Learning experience" and "Learning efficiency" at the 0.001 level. Model 13 showed that the variable "Is the seat by the window and not suffering direct sunlight" was not significantly correlated with "Learning experience" and "Learning efficiency".

Table 4. Post hoc analysis on unit1 with "Learning experience" as the dependent variable (N = 280).

Variables	Model 10	Model 11
Gender	−0.255 (0.114)	−0.197 (0.223)
Education degree	−0.060 (0.715)	−0.067 (0.680)
Is the seat by the window &suffering direct sunlight		−0.684 * (0.024)
R^2	0.011	0.033
F value	1.316	5.180

Notes: * $p < 0.05$.

Table 5. Post hoc analysis on unit 2 with "Learning experience" as the dependent variable (N = 280).

Variables	Model 12	Model 13
Gender	−0.172 (0.578)	−0.132 (0.673)
Education degree	0.562 (0.227)	0.630 (0.183)
Is the seat by the window & not suffering direct sunlight		−0.289 (0.372)
R^2	0.050	0.067
F value	1.149	0.815

These results indicated a contradictory phenomenon, that is, consumers pursued the window seat, which was in line with their preferences, but windows not only bring comfortable outdoor visual and heat experience but also can cause glare problem in some periods. At the moment of glare occurrence, the high learning experience and efficiency brought by consumers because of the behavior of consumption to the right seat, which is in line with their inner expectation, was disturbed.

Table 6. Post hoc analysis on unit1 with "Learning efficiency" as the dependent variable (N = 280).

Variables	Model 14	Model 15
Gender	−0.115 (0.498)	−0.062 (0.718)
Education degree	−0.139 (0.422)	−0.146 (0.398)
Is the seat by the window & suffering direct sunlight		−0.631 * (0.048)
R^2	0.005	0.022
F value	0.543	3.946

Notes: * $p < 0.05$.

Table 7. Post hoc analysis on unit2 with "Learning efficiency" as the dependent variable (N = 280).

Variables	Model 16	Model 17
Gender	−0.040 (0.918)	0.025 (0.950)
Education degree	0.693 (0.238)	0.802 (0.177)
Is the seat by the window & not suffering direct sunlight		−0.467 (0.251)
R^2	0.035	0.065
F value	0.800	1.355

6. Discussion and Conclusions

This study analyzes the mental model framework of occupant behavior as a seat consumer toward the window seat consumption in the context of an academic library. Research shows consumer attitudinal factors, behavioral factors, and cognitive factors are correlated with learning experience and learning efficiency, and the satisfaction of these factors has a more direct effect on learning experience. It is worth pointing out that in this study, we divided the visual and thermal experience into the lighting experience caused by the proximity of windows, the thermal experience caused by sunlight irradiation, and the conventional indoor visual experience and thermal experience caused by the HVAC system of the library building. The analysis results show that there is a positive correlation between the solar lighting introduced by the window and the thermal sensory experience and learning experience brought by the solar irradiation, as well as the learning efficiency. Thermal experience caused by indoor HVAC system control is not significantly correlated with learning experience nor learning efficiency, which is partly due to the stable indoor thermal environment provided by the centralized HVAC system, which keeps the thermal environment of each area of the library stabilized, so the thermal difference of each seat is not significant.

In addition, the degree of liking of the window seat is positively correlated with the learning experience, but the actual window seat or not is negatively correlated with the learning experience. This point shows us a special amount of involvement in consumption behavior. Although the window seat improves the learning experience and efficiency through a better view and lighting experience and satisfies the consumer preferences and expectations, the glare brought by the windows formed the disturbance factor to a certain extent [67], and this disturbance also provided ideas for our future work.

Overall, the study confirms the stability of the theoretical model proposed based on occupant seat consumption behavior and, similar to other environmental studies, proposes the relationship between indoor environmental experiences and expectations and learning experiences. The expansion lies in the transformation from the thinking mode with architecture as the research subject to the occupant as the main body. Furthermore, targeting this occupant, we change the method from the study of engineering rational people's behavior to the study of emotion and attitude behavior from the perspective of consumers.

Instead of emphasizing the complex causes of individual behavior, it emphasizes the matching of individual cognitive attitude and the actual consumer situation.

We propose the following interior design layout strategies according to user consumption contact points [68].

As shown in Figure 4, library service providers can carry out interior design based on this idea. The overall service design strategy should take into account:

- For the existing indoor seat layout, the attraction of the window seat includes the additional experience it brings, such as lighting and the thermal sensation. This experience can be compensated by the indoor environment experience, achieving the promotion of low occupancy seating areas.
- Although the reason why the window seat is preferred may include a good view and a more relaxed mood, the improvement of learning experience brought by the high occupancy rate of this kind of seat has been verified. The interior design should increase the utilization of seats in this area at a reasonable space density.
- The interior layout of the library provides a guide route for consumers to choose seats. The interior design and renovation should balance the areas that the route passes through, so as to improve the occupancy rate of seats in each area.

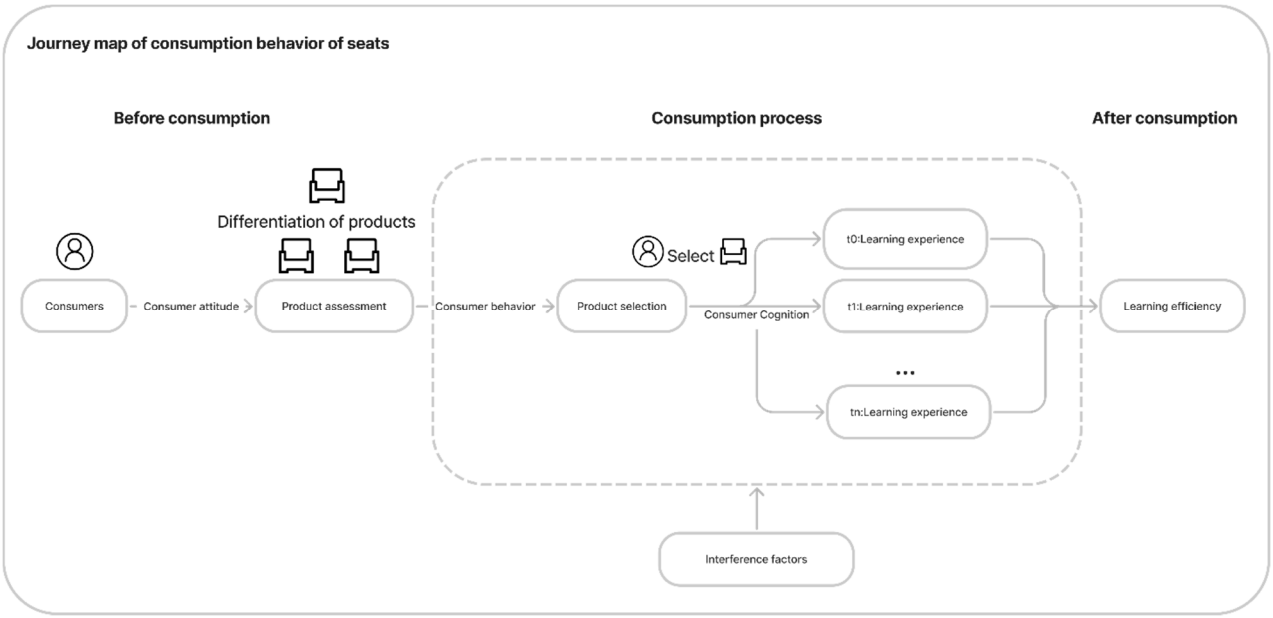

Figure 4. Journey map of consumption behavior of seats.

Finally, in addition to the above strategies, the results of this study still have more guiding significance in reality. Under the influence of the COVID-19 pandemic [69,70], the demand for seating arrangements in many buildings, including libraries, has generated a new application background. This demand is to meet the basic experience, and at the same time, arrange seats to reduce the contact between people.

7. Limitations and Future Research Directions

This study has several limitations that should be considered in the interpretation of the findings and that should be addressed in future research.

First of all, although the proposed affective attitude model provides a new research perspective, the objective cognitive consumption behavior is complex. For example, the glare factor is a clear disturbance, but it has not been taken into account, and more details should be refined in the future.

Second, although choosing a library ensures the stability of the consumer sample, the research results lack the coverage verification of the overall academic library situation. In the future, more extensive sample proofs should be carried out when samples are collected to improve the universality of conclusions for the same type of buildings [71].

Third, simulations are still necessary, for which we have begun to study a behavioral framework for seat selection. In addition to enriching theoretical models, the future research direction also needs to carry out positive behavioral simulation experiments and

help us improve our understanding of the consumption context by comparing it with actual questionnaire conclusions.

In the future, this research will build a more accurate and stable model to describe consumer seat choice in terms of simulation, put forward more intuitive suggestions for interior planning through data visualization drawings, and take dynamic changes into account.

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Appendix A

Library Occupant Behavior Research Questionnaire (Please mark the suitable option with "✓")							
Part I. Individual information							
1. Gender	(1) male		(2) female				
2. Education degree	(1) undergraduate		(2) graduate				
3. Is the seat by the window?	(1) yes		(2) no				
Part II. Seat information (1 = strongly dislike; 2 = slightly dislike; 3 = neutral; 4 = slightly like; 5 = strongly like)							
1. How much do you like window seats?	1		2	3	4		5
2. Visual experience brought by indoor lighting	1		2	3	4		5
3. Visual experience brought by outdoor lighting	1		2	3	4		5
4. Thermal experience brought by indoor environment	1		2	3	4		5
5. Thermal experience brought by outdoor sunlight	1		2	3	4		5
Part III. Learning information							
1. Rate your learning efficiency	1	2	3	4	5	6	7
2. Rate your library experience	1	2	3	4	5	6	7

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