The Impact of Spatial Quality Satisfaction on Place Attachment in Student Dormitories: A Structural Equation Modeling Approach

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Article

The Impact of Spatial Quality Satisfaction on Place Attachment in Student Dormitories: A Structural Equation Modeling Approach

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Abstract

This study develops and tests factor-based and holistic theoretical models to explain the relationships between Spatial Quality Satisfaction (SQS), Overall Dormitory Satisfaction (ODS), and Place Attachment (PA) in student dormitories. Data were collected from 450 students residing in five state-run dormitories in Kırklareli, Turkey, using a questionnaire consisting of three 5-point Likert-type scales. Content validity was ensured through expert review and a pilot study, while construct validity and reliability were established using Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and Cronbach's alpha. The proposed models were tested using Structural Equation Modeling (SEM). The factor-based Model 1 indicates that most SQS factors do not significantly influence ODS and PA when considered individually, whereas "Emotional and Psychological Atmosphere" and "Flexibility of Use" emerge as key determinants. Additionally, ODS exerts a strong and positive effect on PA. Conversely, the holistic Model 2 demonstrates that SQS, when treated as an integrated construct, has a robust and significant effect on both ODS and PA, with ODS playing a critical mediating role in the relationship between SQS and PA. Overall, the findings suggest that enhancing student dormitories through a holistic SQS approach is more effective than interventions focused solely on individual spatial dimensions.

Keywords: spatial quality; place attachment; dormitory satisfaction; student housing; state-run student dormitories; environmental psychology; structural equation modeling; exploratory factor analysis; confirmatory factor analysis

1. Introduction

Beyond being a mere geometric volume defined by physical boundaries, space is a dynamic living environment that gains meaning through physical and sensory experiences, where perceptual and imaginative layers intertwine [1–6]. Space, as a whole consisting of relationships and forms, exists not only through its physical limits but also through the individuals who imbue it with meaning [7,8]. In this context, space constitutes an inseparable part of the individual [9,10]. Similarly, Heidegger [11] argued that humans and space cannot be segregated [12]. Indeed, in this process of unification, space transcends its physical characteristics and, through lived experiences and social values, transforms from a geometric volume into a "place" carrying identity and meaning [4,8,13,14].

Literature on environmental psychology and architecture reveals that 'place' is a product of the interaction and experience process between humans and spaces [5,9,15]. Through these interactions, various direct or indirect connections are formed in cognitive, emotional, and behavioral dimensions [16–18]. One of the most significant bonds formed in this context is place attachment [19–21]. Evaluated within the framework of human-space interaction, place attachment is considered a fundamental human need [22–24].

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Place attachment is crucial for the human-space relationship and is not limited to a specific type of setting [19,21]; it can develop between an individual and any environment [19,25]. In recent years, parallel to the global rise in higher education enrollment, student dormitories—which are rapidly increasing in both number and capacity—have become key spaces for such attachments [26–30]. Dormitories serve as vital environments for accommodation, living, learning, and social interaction [31–33]. However, for students residing in these facilities, the absence or deficiency of place attachment can lead to severe negative consequences, including isolation, alienation, lack of self-confidence, academic failure, low motivation, unhappiness, mental health issues, and the desire to leave the dormitory [34–36]. Therefore, place attachment between students and the dormitory space is of great importance.

Numerous factors influence place attachment, which manifests at different levels and forms [18,21,37], with satisfaction being a primary determinant. Most studies in the literature addressing the relationship between satisfaction and place attachment have indicated that, in the context of human-space interaction, satisfaction with a space helps them develop a special attachment to that space [29,30,38–43]. However, some studies suggest that a meaningful connection between satisfaction and place attachment is not always present [44,45]. These inconsistencies in the literature, combined with the limited scope of existing studies, highlight the need for a more comprehensive approach.

Specifically, in the context of state-run student dormitories, there is a notable absence of studies that:

- propose a theoretical model explaining the interrelationships between Spatial Quality Satisfaction (SQS), Overall Dormitory Satisfaction (ODS), and Place Attachment (PA);
- treat SQS and ODS as distinct variables;
- identify and detail the specific factors constituting SQS and incorporate them into a model;
- examine the effects of each SQS factor, both individually and holistically, on ODS and PA; and
- investigate the mediating role of ODS in the relationship between SQS and PA.

This absence represents a significant gap in the literature. Addressing this gap, the main objective of this study is to develop a theoretical model explaining the relationships between spatial quality satisfaction, overall dormitory satisfaction, and place attachment in state-run student dormitories, and to test the direct and indirect (mediating) effects proposed in the model.

To achieve this main objective, the specific sub-objectives are summarized as follows:

- To identify the criteria and factors constituting SQS in student dormitories;
- To develop a comprehensive "Spatial Quality Satisfaction Scale" and demonstrate its validity and reliability;
- To adapt the "Dormitory Satisfaction Scale" and the "Place Attachment Scale" found in the literature to a local/specific context of student dormitories and present these adapted scales, proving both their validity and reliability;
- To determine the power of each SQS factor to represent the holistic perception of spatial quality satisfaction;
- To examine the individual and holistic effects of SQS factors on ODS and PA;
- To investigate the mediating role of ODS in the relationship between SQS factors and PA.

The research scope is limited to examining the direct and indirect (mediating) effects of the sub-dimensions of SQS and the overall perception of SQS on ODS and PA within the framework of the developed theoretical model. The study area comprises all state-run student dormitories serving higher education students in the Central District of Kırklareli Province.

In alignment with the purpose and scope, the following research questions (RQ) were formulated:

- RQ1: What are the criteria and factors constituting spatial quality satisfaction in student dormitories?
- RQ2: How does satisfaction with each main factor of spatial quality affect overall dormitory satisfaction?

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- RQ3: How does satisfaction with each main factor of spatial quality affect place attachment?
- RQ4: How does overall dormitory satisfaction mediate the effect of satisfaction with each main spatial quality factor on place attachment?
- RQ5: How does overall dormitory satisfaction affect place attachment?
- RQ6: To what extent does satisfaction with each main factor of spatial quality represent the overall perception of spatial quality satisfaction?
- RQ7: How does the perception of overall spatial quality satisfaction affect overall dormitory satisfaction?
- RQ8: How does the perceived overall spatial quality satisfaction affect place attachment?
- RQ9: What is the role of overall dormitory satisfaction as a mediating variable in the effect of overall spatial quality satisfaction on place attachment?

The structure of the study has been designed to find answers to the defined research questions above. The "Theoretical Framework" section presents the sub-topics pivotal to the theoretical model—place attachment, spatial quality satisfaction, and their interrelationships—based on a literature review. The "Methodology" section details the developed theoretical models (factor-based and holistic), survey design, study area, sampling method, data collection process, and the validity (EFA and CFA) and reliability (Cronbach's Alpha) analyses of the scales, along with the data analysis method (Structural Equation Modeling). The "Results" section reports the findings obtained from the SEM analysis used to test the research models. The "Discussion" section evaluates these findings in the context of existing literature. Finally, the "Conclusions and Recommendations" section presents the study's conclusions, original contributions, limitations, and suggestions for future research.

2. Theoretical Framework

2.1. Place Attachment

There is a multidimensional, multilayered, and inherently reciprocal interaction between humans and space [5,9,15]. This interaction, fueled by spatial experiences, facilitates the formation of various bonds that emerge in cognitive, emotional, and behavioral dimensions [16–18]. Among these bonds, one of the most frequently discussed and defining concepts in the literature is place attachment [19–21].

Although place attachment—a bond established between the user and the space itself—was first conceptualized by Low and Altman [21], the roots of the concept lie in research conducted across various disciplines such as environmental psychology, architecture, design, and planning since the 1960s. Evaluated within the framework of human-space interaction, it is considered one of the most difficult concepts to define in the literature [20]. Consequently, researchers have developed various definitions. Relph [14] describes place attachment as a unique and emotional bond formed with an environment that meets basic human needs. Similarly, Tuan [46] characterizes it as an aesthetic, tactile, and emotional bond. Low and Altman [21] define it as a multifaceted bond between people and the places they consider important, while Hidalgo and Hernández [19] refer to it as an emotional bond formed in places where people feel comfortable and tend to remain. Furthermore, Scannell and Gifford [23] view it as a cognitive and emotional bond between individuals and significant places, whereas Ardekani and Helmi [47] describe it as a strong bond that deepens over time.

Examining these definitions, it is evident that place attachment is shaped by the meaning individuals ascribe to a place over time and is fundamentally rooted in the human-space relationship. Formed by emotional, functional, and conceptual bonds, place attachment is a fluid, variable, and multifaceted process rather than a static state [10,48]. Therefore, it can manifest at different levels and in diverse forms [19,21].

Regardless of the level or form in which it occurs, place attachment is a fundamental need inherent to human nature and holds particular importance [22–24]. Situated at the center of human-space interaction, place attachment offers numerous benefits for both the space and the individual. These benefits can be summarized as follows [21,23,47]:

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- It enhances individuals' sense of security, pleasure, and emotional perception.
- It assists individuals in expressing their actions and behaviors.
- It provides an important reference for individuals to understand their own identity and express themselves.
- It contributes to well-being and improves quality of life.
- It plays a key role in enabling individuals to maintain their presence in the space by transforming the atmosphere from impersonal to intimate.
- It enables the space to be embraced, protected, and personalized by its users.
- It helps reduce feelings of alienation and loneliness by establishing a connection with the social environment.

Place attachment is not limited to a single scale or space [19,21]; it can develop between individuals and places of various scales, such as rooms, houses, buildings, streets, neighborhoods, districts, cities, and countries [19,25]. In recent years, parallel to the global increase in the number of universities and students, student dormitories—which have shown rapid growth in both number and capacity—have also emerged as spaces where individuals can develop attachment [26–30]. Student dormitories are crucial for young adults in terms of accommodation, living, learning, social communication, and interaction [31–33]. Students residing in dormitories may encounter experiences distinct from their home lives and face emotional difficulties while adapting to this new environment [34,49]. In this context, place attachment plays a vital role in mitigating the impact of such negative experiences by making students feel at home, enhancing their quality of life and mental health, and increasing their academic success and interaction with the environment [47,50,51]. For this reason, fostering place attachment between students and the dormitory is essential.

2.2. Spatial Quality Satisfaction

The concept of quality, implying a "level of excellence" or "superior characteristics," is inherently linked to the notion of value. It is a multidimensional, multifaceted, and subjective concept perceived and defined in diverse ways depending on the context [52–54]. Consequently, there is no universally accepted standard definition of "quality," as it is generally used across various fields to distinguish whether an entity (product, project, physical intervention, etc.) is "better" or "worse" [55,56]. Similarly, the concept of "spatial quality" eludes a simple definition, as it is a phenomenon evaluated through different dimensions and meanings across various disciplines [57–59].

In general, spatial quality [60]—used to express the extent to which the physical, social, psychological, aesthetic, safety, and technical characteristics of a space meet specified requirements—has been conceptualized by researchers as a construct consisting of various dimensions. For instance, Greene [61] characterizes spatial quality as a structure comprising function, order, identity, and appeal/attraction; Van der Voordt and Van Wegen [59] define it through the dimensions of functional quality, aesthetic quality, technical quality, and economic quality. Conversely, Preiser et al. [62] assessed it via the dimensions of technical, functional, and behavioral performance.

Being a multidimensional construct influenced by numerous elements, spatial quality has held significant importance in many fields, particularly in design disciplines, both historically and currently [15,63]. Therefore, it requires careful evaluation and examination. The unique context and distinct characteristics of each space, combined with the subjective and variable nature of users' perceptions, make spatial quality difficult to measure and evaluate [64,65]. Thus, various tools are employed for its assessment [62,66]. In architectural research, user satisfaction assessments are considered a fundamental tool for measuring and evaluating spatial quality, as they reflect users' perceptions of the space [67–69].

This study utilizes user satisfaction assessments to measure the spatial quality of student dormitories. To articulate the students' overall level of satisfaction with the spatial quality attributes perceived in their dormitories, the term "spatial quality satisfaction"—combining the concepts of "spatial quality" and "user satisfaction"—has been adopted. This concept aims to integrate users' spatial experiences with the quality offered by the space.

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2.3. The Relationship Between Place Attachment and Spatial Quality Satisfaction

The formation and development of place attachment, which holds significant importance from both human and spatial perspectives, are influenced by numerous factors, ranging from the physical, environmental, social, and cultural characteristics of the space to the individual's personality, socio-demographic characteristics, and the duration of their experience within the space [18,21,37]. The perceived quality of a space [70–74] and the satisfaction derived from that space [38–43] are also among these factors.

In the context of student dormitories, a limited number of studies in the literature have shown that students' satisfaction with their dormitory enhances their place attachment. For instance, Khozaei et al. [29] conducted a survey with 267 students residing in dormitories at a state university in Malaysia to investigate whether there was a significant relationship between dormitory satisfaction and place attachment. The study concluded that dormitory satisfaction positively affects place attachment. Similarly, Khozaei et al. [30] surveyed 751 students to examine the possibility that dormitory satisfaction mediates the relationship between fulfilled preferences and place attachment. Their study demonstrated that fulfilled preferences in student dormitories positively affect both dormitory satisfaction and place attachment, and that dormitory satisfaction plays a significant mediating role in the effect of fulfilled preferences on place attachment.

Conversely, there are also studies [44,45] suggesting that there is no significant relationship between satisfaction and place attachment. These conflicting findings in the literature and the limitations of existing studies necessitate in-depth investigation of the subject. To this end, a conceptual research model was developed to examine the direct and indirect relationships between spatial quality satisfaction, overall dormitory satisfaction, and place attachment in the context of student dormitories.

3. Methodology

3.1. Theoretical Model

To develop the proposed theoretical models, the main factors and their corresponding criteria (items) were comprehensively identified. Accordingly, the following factors were determined: "Urban Location and Transportation (ULT)", "Spatial Organization and Accessibility (SOA)", "Comfort and Service Conditions (CSC)", "Safety and Structural Resilience (SSR)", "Facility Amenities (FA)", "Nearby Environment Conditions and Facilities (NEC)", "Flexibility of Use (FU)", "Visual (Aesthetic) Quality (VQ)", "Socio-cultural Interaction and Solidarity (SIS)", and "Emotional and Psychological Atmosphere (EPA)". This identification addresses the preliminary research question (RQ1) of the study.

Table 1. Factors and criteria of spatial quality satisfaction in student dormitories.

Factors	Criteria / Items	Related Literature
Urban Location and Transportation (ULT)	ULT1: Ease of transportation from the dormitory to the university campus ULT2: Ease of transportation from the dormitory to the city center ULT3: Location of the dormitory within the city	[26,27,30,31, 75–91]
Spatial Organization and Accessibility (SOA)	SOA1: Ease of access from the dorm room to other spaces of the dormitory SOA2: Location of dormitory spaces within the dormitory complex SOA3: Ease of movement/circulation within the dormitory spaces SOA4: Suitability of dormitory spaces for individuals with physical disabilities SOA5: Location of entrances (complex, building) in the dormitory SOA6: Dimensions of dormitory spaces (height, width, depth) SOA7: The shape/form of the dormitory spaces SOA8: Orientation of dormitory spaces	[26,27,31,32, 58,76–82,84–106]

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	SOA9: Internal layout/arrangement of dormitory spaces	
Comfort and Service Conditions (CSC)	CSC1: Air quality conditions in dormitory spaces CSC2: Physical quality conditions in dormitory spaces (absence of moisture, dampness, water leaks, etc.) CSC3: Thermal comfort conditions in dormitory spaces CSC4: Acoustic comfort conditions in dormitory spaces CSC5: Lighting comfort conditions in dormitory spaces CSC6: General cleanliness/hygiene conditions in dormitory spaces CSC7: Number/capacity of trash bins in dormitory spaces CSC8: Maintenance and repair conditions in dormitory facilities CSC9: General operation/service conditions in dormitories	[26,27,30–32,58,76–81,83–102,104–107]
Safety and Structural Resilience (SSR)	SSR1: Security control status at dormitory entrances/exits (complex, building) SSR2: Security status of dormitory premises against theft SSR3: Safety status of dormitory premises against physical accidents SSR4: General safety status of the dormitory against animal attacks SSR5: General safety status of the dormitory against fire incidents SSR6: General resilience of the dormitory against natural disasters	[26,27,30,31,58,75–82,84–86,89–92,97,99–102,104–107]
Facility Amenities (FA)	FA1: Availability of interior furnishings and small appliances in dormitory FA2: Facilities for parking vehicles (cars, motorcycles, etc.) in dormitory FA3: Facilities for socio-cultural activity areas in dormitory FA4: Facilities for relaxation/lounge areas in dormitory FA5: Recreation and entertainment facilities in dormitory FA6: Educational/study area facilities in dormitory FA7: Daily living and service area facilities in dormitory FA8: Infrastructure and communication systems facilities in dormitory	[26,27,30–32,58,75,78–92,94,95,97–107]
Nearby Environment Conditions and Facilities (NEC)	NEC1: Nearby environment physical conditions NEC2: Nearby environment socio-cultural conditions NEC3: Nearby environment commercial and employment facilities NEC4: Nearby environment healthcare facilities NEC5: Nearby environment social facilities NEC6: Nearby environment recreation and entertainment facilities NEC7: Nearby environment educational facilities	[26,27,58,81,82,84,86,88,89,92,94,100-102,104,106]
Flexibility of Use (FU)	FU1: Flexibility to personalize/modify of dormitory spaces FU2: Flexibility to personalize/modify comfort conditions in dormitory spaces FU3: Functionality diversity/flexibility in dorm rooms	[30–32,58,78,80,89,93–102,104]
Visual (Aesthetic) Quality (VQ)	VQ1: Visual appeal (color, texture, style, etc.) of dormitory spaces VQ2: The pleasantness and attractiveness of the view from dormitory spaces VQ3: The harmony of the overall appearance of the dormitory complex with its surroundings	[26,27,30–32,58,76–81,86,89,91,92,94,95,97–104]
Socio-cultural Interaction and Solidarity (SIS)	SIS1: Individuals' desire to engage in social interaction within dormitory spaces SIS2: The level of social interaction within dormitory spaces SIS3: Level of overall social solidarity in dormitory SIS4: Level of overall cultural interaction in dormitory	[27,30–32,78,81,83,84,86,88,92,93,95,97,100,101,106,108]
Emotional and Psychological Atmosphere (EPA)	EPA1: Level of privacy in dormitory spaces EPA2: Level of peacefulness in dormitory spaces EPA3: Level of freedom in dormitory spaces EPA4: Level of happiness in dormitory spaces EPA5: Level of intimacy in dormitory spaces EPA6: The overall effect of dormitory spaces on individuals' mood	[26,27,30–32,58,76–82,84,89,92–95,97–103,105–108]

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Following the determination of the factors and criteria constituting spatial quality satisfaction in student dormitories, two distinct theoretical models—one factor-based and one holistic—were developed in alignment with the research questions, theoretical framework, and literature review.

Model 1 (Factor-Based) examines the individual effects of the 10 factors constituting spatial quality satisfaction on overall dormitory satisfaction and place attachment, while accounting for the interrelationships among these factors. Furthermore, it investigates the mediating role of overall dormitory satisfaction in the relationship between each of the 10 factors and place attachment (Figure 1).

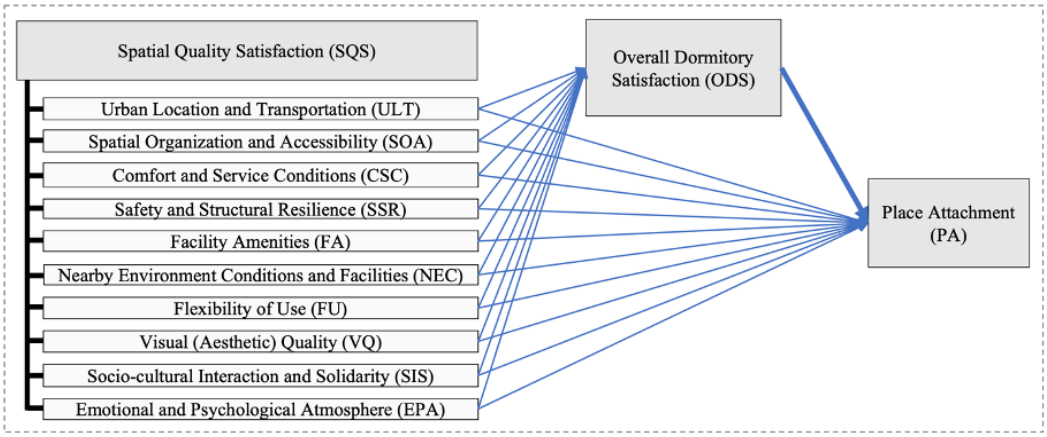

Figure 1. Theoretical model-1 (factor-based).

Model 2 (Holistic) evaluates the effect of spatial quality satisfaction in student dormitories as an integrated construct on overall dormitory satisfaction and place attachment. Additionally, it examines the mediating role of overall dormitory satisfaction in the relationship between holistic spatial quality satisfaction and place attachment (Figure 2).

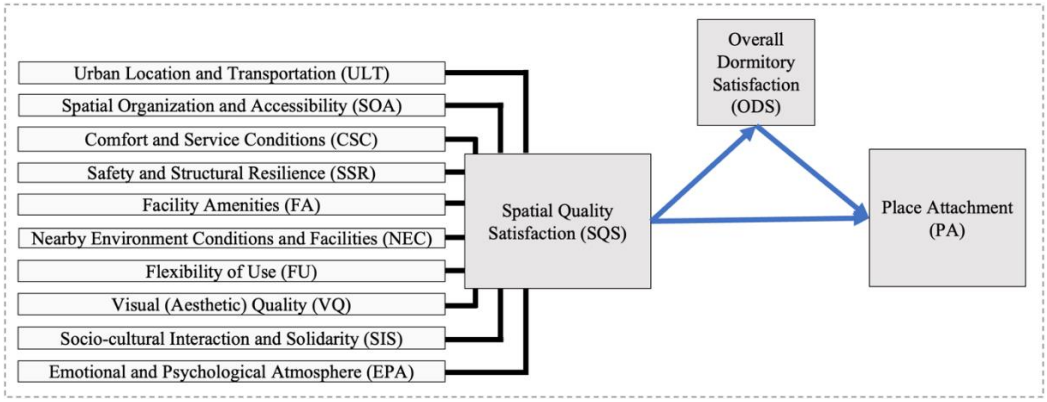

Figure 2. Theoretical model-2 (holistic).

3.2. Instrument Design

Questionnaires are among the most common tools enabling systematic and efficient data collection [109,110]. Through rigorous design, questionnaires allow for high-quality measurements, yielding accurate and reliable data [70,110]. Accordingly, a draft survey form comprising four main sections was designed to align with the proposed theoretical models. The survey targeted higher education students residing in state-run dormitories in the Central District of Kırklareli Province.

First, a "Participant Information Section" was developed, containing 12 multiple-choice and open-ended questions to gather demographic details such as gender, age, department, class year, and current dormitory. Second, to measure spatial quality satisfaction, the "Student Dormitories Spatial

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Quality Satisfaction Scale" was formulated. This scale comprises 59 items distributed across 10 factors, utilizing a 5-point Likert format. Its development was based on the identified factors and criteria, comprehensive literature review, and personal experience spanning five years in state-run dormitories. Third, to measure place attachment, Lewicka's [37] validated "Place Attachment Scale" (12 items, single factor) was adapted to the dormitory context. This adaptation resulted in the "Student Dormitories Place Attachment Scale." Fourth, to measure overall dormitory satisfaction, the "Dormitory Satisfaction Scale" developed by Khozaei et al. [30] (5 items, single factor) was adapted. Consequently, the "Overall Dormitory Satisfaction Scale" was created in a 5-point Likert format.

Following the initial design, the content validity and comprehensibility of the questionnaire were assessed through consultation with three experts and a pilot study involving 10 dormitory residents. Based on the feedback, several revisions were implemented: (1) scale items were refined for greater clarity, and (2) the sequence of sections was reorganized to maintain participant engagement effectively throughout the survey. Consequently, the final survey form was established (Appendix A).

3.3. Study Area and Sample

The research area comprises all state-run higher education student dormitories located in the Central District of Kırklareli Province, namely: the Evlad-ı Fatihan Female Student Dormitory (Figure 3a), Hundi Hatun Female Student Dormitory (Figure 3b), Ahmet Cevdet Pasha Male Student Dormitory (Figure 3c), Şemseddin Sami Male Student Dormitory (Figure 3d), and Kırklareli Male Student Dormitory (Figure 3e) [111].

(**a**)

(**b**)

(**c**)

(**d**)

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(**e**)

Figure 3. State-run student dormitories in the Central District of Kırklareli Province: (**a**) Evlad-ı Fatihan Female Student Dormitory; (**b**) Hundi Hatun Female Student Dormitory; (**c**) Ahmet Cevdet Pasha Male Student Dormitory; (**d**) Şemseddin Sami Male Student Dormitory; (**e**) Kırklareli Male Student Dormitory [111].

To determine the study population, the total capacities of these dormitories were identified. As presented in Table 2, the combined capacity is 6,954 students [112].

Table 2. Capacities of state-run student dormitories in the Central District of Kırklareli Province [112].

Dormitory Name	Capacity (Student)
Evlad-ı Fatihan Female Student Dormitory	2,250
Hundi Hatun Female Student Dormitory	2,000
Ahmet Cevdet Pasha Male Dormitory	1,500
Şemseddin Sami Male Student Dormitory	624
Kırklareli Male Student Dormitory	580
Total	6,954

Based on the total population, the minimum required sample size was determined to be 364 participants, utilizing Sekaran's [113] table of sample sizes for specific populations. However, to enhance measurement precision and ensure robust results, the final sample size was increased to 450 participants.

To ensure representative distribution, stratified random sampling was employed. Accordingly, participants were selected proportionally based on the capacity of each dormitory: 146 participants from Evlad-ı Fatihan Female Student Dormitory, 129 from Hundi Hatun Female Student Dormitory, 97 from Ahmet Cevdet Pasha Male Student Dormitory, 40 from Şemseddin Sami Male Student Dormitory, and 38 from Kırklareli Male Student Dormitory (Table 3).

Table 3. Proportional distribution of participants according to the dormitories they reside in, based on stratified sampling.

Dormitory Name	Capacity (Student)	Proportional Distribution
Evlad-ı Fatihan Female Student Dormitory	2,250 →	146
Hundi Hatun Female Dormitory	2,000 →	129
Ahmet Cevdet Pasha Male Student Dormitory	1,500 →	97
Şemseddin Sami Male Student Dormitory	624 →	40
Kırklareli Male Student Dormitory	580 →	38
Total	6,954 →	450

3.4. Data Collection Method and Process

Research data were collected through face-to-face surveys using a structured questionnaire. Prior to data collection, ethical approval was obtained from the Yıldız Technical University Social and Human Sciences Research Ethics Committee on June 30, 2025 (Report No: 20250605681;

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Verification Code: 34634). Subsequently, verbal permission was secured from the Kırklareli Provincial Directorate of the Ministry of Youth and Sports (MoYS) to access the dormitories. Following these approvals, field studies were conducted in five dormitories, where face-to-face interviews lasting approximately 10–15 minutes were held with participants, strictly adhering to the stratified sampling targets determined for each dormitory.

To ensure data quality, a rigorous validation process was implemented immediately after the field visits. Incomplete or incorrectly filled forms were identified and excluded; to compensate for these, additional surveys were conducted with new participants to reach the target sample size. The final valid dataset (n = 450) was recorded in MS Excel, followed by a verification process to ensure data entry accuracy. The demographic characteristics of the participants constituting the final dataset are presented in Appendix B.

3.5. Validity and Reliability Analyses

Reliability and validity constitute the two fundamental criteria for evaluating measurement quality in survey research. Reliability refers to the consistency of a measurement instrument under identical conditions, indicating the degree to which results are free from measurement error. Conversely, validity concerns the extent to which an instrument accurately measures the intended construct without confounding it with other characteristics. Since reliability does not guarantee validity, both must be rigorously established in scale adaptation studies [114,115].

In this study, construct validity was examined using Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) via SPSS 25.0 and AMOS 23.0 software, respectively. EFA was employed to uncover the underlying factor structure of the variables [116,117], while CFA was utilized to test the fit of the data to the hypothesized model [118]. The reliability of the scales was assessed using Cronbach's Alpha coefficient [119].

3.5.1. Validity and Reliability Analyses of the Spatial Quality Satisfaction Scale

Prior to conducting Exploratory Factor Analysis (EFA), the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was calculated. The analysis yielded a KMO value of 0.941 (Table 4), indicating that the sample size was highly satisfactory for factor analysis [120,121]. Furthermore, Bartlett's Test of Sphericity was statistically significant ($\chi^2(1540) = 18982.879$; $p<0.001$), confirming that the correlation matrix was suitable for factorization (Table 4) [110,122,123].

Upon confirming data suitability, EFA was performed. Adhering to the recommended lower threshold of 0.40 in the literature [110,120,124], three items exhibiting cross-loadings (FA1, FA8, and EPA1) were removed to ensure factor distinctiveness [109,110,120]. The remaining 56 items converged into 10 theoretically predicted factors, with all items loading significantly onto their respective constructs (Table 4). Notably, the total variance explained by this structure was 68.324% (Table 4). Since a total variance explained of 50% or above is considered adequate [109,120,125], this result supports the proposed factor structure. Reliability was assessed using Cronbach's Alpha internal consistency coefficient. The analysis revealed a Cronbach's Alpha of 0.961 (Table 4), indicating a very high level of internal consistency [109,126,127].

Table 4. Exploratory factor analysis (EFA) results of the spatial quality satisfaction scale.

Items	**Factors**									
	F1 (ULT)	**F2 (SOA)**	**F3 (CSC)**	**F4 (SSR)**	**F5 (FA)**	**F6 (NEC)**	**F7 (FU)**	**F8 (VQ)**	**F9 (SIS)**	**F10 (EPA)**
ULT2	0.774									
ULT3	0.646									
ULT1	0.546									
SOA2		0.812								
SOA3		0.733								
SOA1		0.699								

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SOA7		0.675								
SOA5		0.632								
SOA6		0.620								
SOA9		0.601								
SOA4		0.588								
SOA8		0.544								
CSC2			0.693							
CSC3			0.682							
CSC1			0.643							
CSC4			0.613							
CSC6			0.581							
CSC5			0.575							
CSC8			0.574							
CSC7			0.541							
CSC9			0.419							
SSR2				0.756						
SSR4				0.731						
SSR1				0.712						
SSR5				0.702						
SSR6				0.657						
SSR3				0.646						
FA3					0.785					
FA4					0.783					
FA5					0.764					
FA6					0.706					
FA7					0.627					
FA2					0.526					
NEC3						0.885				
NEC4						0.873				
NEC5						0.848				
NEC6						0.836				
NEC2						0.822				
NEC7						0.770				
NEC1						0.582				
FU2							0.774			
FU3							0.720			
FU1							0.643			
VQ2								0.659		
VQ3								0.642		
VQ1								0.571		
SIS2									0.823	
SIS4									0.776	
SIS3									0.773	
SIS1									0.732	
EPA6										0.764
EPA7										0.751
EPA4										0.725
EPA5										0.710
EPA3										0.685
EPA2										0.655
Reliability	0.537	0.890	0.888	0.875	0.901	0.944	0.755	0.847	0.899	0.926
Total Reliability					0.961					

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Explained Variance (%)	2.898	9.005	8.865	7.351	7.698	11.223	3.808	3.842	5.790	7.844
Total Explained Variance (%)	68.324									
KMO = 0.941; χ2(1540) = 18,982.879; Bartlett's Sphericity Test (p) < 0.001										

Following EFA and reliability analysis, Confirmatory Factor Analysis (CFA) was conducted. Model fit was initially assessed by examining indices including CMIN/DF, RMSEA, CFI, TLI, IFI, RFI, NFI, and SRMR [117,120,124,128,129]. Initial results indicated a need for refinement. Based on modification indices, items contributing to model misfit were identified, and covariance paths were defined between the error terms of items exhibiting high residual covariance. Consequently, the re-estimated model demonstrated a good fit to the data (Table 5).

Table 5. Fit indices for the structural model of the spatial quality satisfaction scale.

Fit Index	Model Values	Acceptable Values
CMIN/DF	2.436	≤5
RMSEA	0.057	≤0.10
CFI	0.887	≥0.80
TLI	0.879	≥0.80
IFI	0.888	≥0.80
RFI	0.811	≥0.80
NFI	0.824	≥0.80
SRMR	0.064	≤0.10

Examination of the CFA findings (Figure 4, Table 6) reveals that all scale items exhibit statistically significant factor loadings ($p<0.001$) exceeding the acceptable threshold of 0.40 [110,120,124]. Furthermore, the t-values for all items significantly exceeded the critical value of 1.96. These findings demonstrate that the items significantly represent their respective factors and that the factor-item relationships within the measurement model possess convergent validity [124,130]. Consequently, the CFA results confirm the construct validity of the scale.

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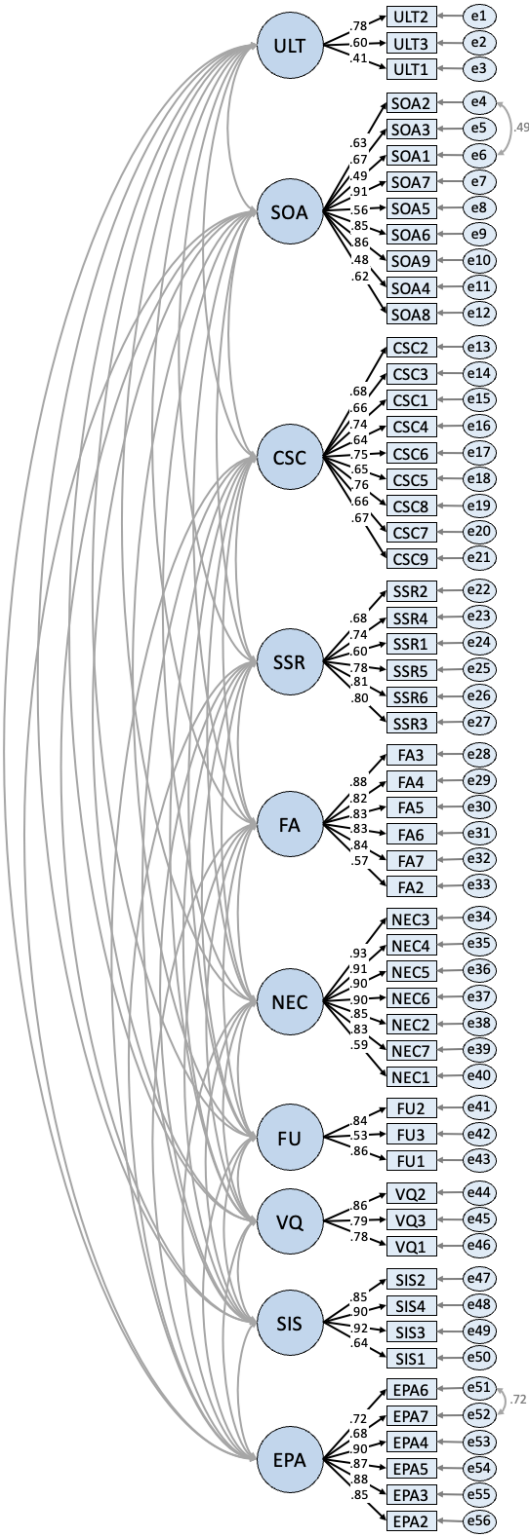

Figure 4. First-order multiple factor CFA model of the spatial quality satisfaction scale.

Table 6. Results related to the measurement model of the spatial quality satisfaction scale.

Factors	Items	Factor Loadings	Standard Errors	t Values	p Values
F1 (ULT)	ULT2	0.778	-	-	-
	ULT3	0.602	0.121	8.505	***
	ULT1	0.412	0.096	5.935	***
F2 (SOA)	SOA2	0.627	-	-	-
	SOA3	0.672	0.090	12.282	***

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	SOA1	0.491	0.057	12.805	***
	SOA7	0.905	0.102	15.261	***
	SOA5	0.563	0.107	10.614	***
	SOA6	0.846	0.103	14.594	***
	SOA9	0.857	0.103	14.723	***
	SOA4	0.478	0.101	9.202	***
	SOA8	0.619	0.105	11.491	***
F3 (CSC)	CSC2	0.677	-	-	-
	CSC3	0.655	0.063	12.715	***
	CSC1	0.738	0.068	14.152	***
	CSC4	0.640	0.077	12.446	***
	CSC6	0.752	0.074	14.395	***
	CSC5	0.653	0.059	12.673	***
	CSC8	0.761	0.073	14.546	***
	CSC7	0.664	0.081	12.874	***
	CSC9	0.671	0.087	12.990	***
F4 (SSR)	SSR2	0.681	-	-	-
	SSR4	0.743	0.079	14.108	***
	SSR1	0.599	0.055	11.605	***
	SSR5	0.780	0.072	14.707	***
	SSR6	0.806	0.067	15.125	***
	SSR3	0.802	0.065	15.057	***
F5 (FA)	FA3	0.878	-	-	-
	FA4	0.817	0.047	22.540	***
	FA5	0.825	0.047	22.941	***
	FA6	0.826	0.044	22.979	***
	FA7	0.842	0.030	23.809	***
	FA2	0.566	0.056	13.105	***
F6 (NEC)	NEC3	0.934	-	-	-
	NEC4	0.906	0.029	33.975	***
	NEC5	0.903	0.031	33.635	***
	NEC6	0.896	0.031	32.816	***
	NEC2	0.845	0.036	27.939	***
	NEC7	0.833	0.037	26.950	***
	NEC1	0.587	0.047	14.517	***
F7 (FU)	FU2	0.836	-	-	-
	FU3	0.534	0.073	11.085	***
	FU1	0.850	0.050	17.368	***
F8 (VQ)	VQ2	0.861	-	-	-
	VQ3	0.793	0.052	19.117	***
	VQ1	0.780	0.043	18.714	***
F9 (SIS)	SIS2	0.853	-	-	-
	SIS4	0.899	0.048	25.395	***
	SIS3	0.924	0.047	26.517	***
	SIS1	0.641	0.050	15.134	***
F10 (EPA)	EPA6	0.715	-	-	-
	EPA7	0.683	0.036	26.680	***
	EPA4	0.900	0.056	18.679	***
	EPA5	0.870	0.055	18.058	***
	EPA3	0.882	0.055	18.296	***
	EPA2	0.854	0.053	17.721	***

***p<0.001

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3.5.2. Validity and Reliability Analyses of the Place Attachment Scale

Sample suitability for the Place Attachment Scale was confirmed with a KMO value of 0.860 (Table 7), indicating a highly adequate sample size [120,121]. Additionally, Bartlett's Test of Sphericity yielded statistically significant results ($\chi^2(45) = 1583.345$, $p<0.001$), verifying the suitability of the correlation matrix for factorization (Table 7) [110,122,123].

During the EFA process, two items (PA1=0.204 and PA8=0.058) falling below the recommended loading threshold of 0.40 [110,120,124] were excluded to ensure structural clarity [109,110,120,123]. The remaining 10 items clustered under a single factor, as theoretically predicted (Table 7). This single-factor structure explained 43.864% of the total variance (Table 7). Considering that an explained variance of 40% or higher is deemed adequate for single-factor scales in social sciences [109,120,125], this result validates the factor structure. Reliability analysis yielded a Cronbach's Alpha coefficient of 0.839 (Table 7), demonstrating a high level of internal consistency [109,126,127].

Table 7. Exploratory factor analysis (EFA) results of the place attachment scale.

Items	F1: Place Attachment (PA)
PA7	0.756
PA6	0.740
PA4	0.719
PA3	0.707
PA11	0.696
PA10	0.694
PA2	0.687
PA12	0.630
PA9	0.473
PA5	0.437
Reliability	0.839
Explained Variance (%)	43.864
KMO = 0.860; χ2(45) = 1583.345; Bartlett's Sphericity Test (p) < 0.001	

Subsequently, CFA was conducted using standard fit indices [117,120,124,128,129]. Initial assessments indicated a need for refinement; therefore, modifications were implemented in the measurement model. The re-estimated model exhibited fit indices within acceptable limits, demonstrating a good overall fit (Table 8).

Table 8. Goodness-of-fit values for the structural model of the place attacment scale.

Fit Index	Model Values	Acceptable Values
CMIN/DF	4.278	≤5
RMSEA	0.085	≤0.10
CFI	0.932	≥0.80
TLI	0.905	≥0.80
IFI	0.933	≥0.80
RFI	0.880	≥0.80
NFI	0.914	≥0.80
SRMR	0.048	≤0.10

Examination of the CFA findings (Figure 5, Table 9) reveals that factor loadings are generally statistically significant ($p<0.001$) and exceed 0.40. Although Item PA5 exhibited a factor loading of 0.372, it was retained in the measurement model. This decision is supported by literature suggesting that loadings above 0.30 are acceptable for large sample sizes [109,120,124,131], and by the item's theoretical significance to the construct of place attachment. Moreover, all t-values surpassed the

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critical threshold of 1.96. Consequently, the CFA results confirm the construct validity and suitability of the scale [124,130].

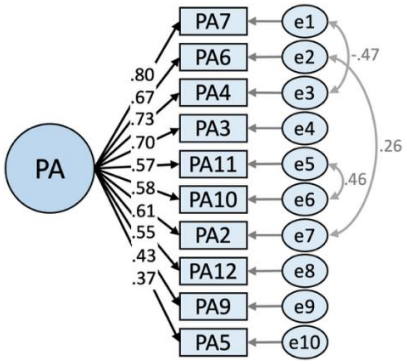

Figure 5. Single-factor CFA model of the place attachment scale.

Table 9. Results related to the measurement model of the place attachment scale.

Factors	Items	Factor Loadings	Standard Errors	t Values	p Values
F1 (PA)	PA7	0.796	-	-	-
	PA6	0.668	0.054	13.856	***
	PA4	0.727	0.061	12.770	***
	PA3	0.695	0.057	14.499	***
	PA11	0.570	0.062	11.746	***
	PA10	0.583	0.058	12.046	***
	PA2	0.607	0.057	12.489	***
	PA12	0.551	0.057	11.355	***
	PA9	0.429	0.062	8.756	***
	PA5	0.372	0.056	7.572	***

***p<0.001

3.5.3. Validity and Reliability Analyses of the Overall Dormitory Satisfaction Scale

Regarding the final scale, the KMO value was calculated as 0.837 (Table 10), indicating sample adequacy [120,121]. Furthermore, Bartlett's Test of Sphericity was statistically significant ($\chi^2(10) = 1448.301$, $p<0.001$), confirming the suitability of the data for factor analysis (Table 10) [110,122,123].

The EFA results revealed that all items loaded onto a single factor with loadings exceeding the 0.40 threshold [110,120,124] and no significant cross-loadings (Table 10). Notably, the total variance explained by this factor structure was substantial at 71.535% (Table 10). Given that an explained variance of 40% or above is deemed adequate for single-factor scales [109,120,125], this result confirms the robustness of the structure. Reliability analysis yielded a Cronbach's Alpha of 0.899 (Table 10), reflecting high internal consistency [109,126,127].

Table 10. Exploratory factor analysis (EFA) results of the overall dormitory satisfaction scale.

Items	F1: Overall Dormitory Satisfaction (ODS)
ODS2	0.893
ODS3	0.866
ODS4	0.846
ODS1	0.843
ODS5	0.777
Reliability	0.899
Explained Variance (%)	71.535
KMO = 0.837; χ2(10) = 1448.301; Bartlett's Sphericity Test (p) < 0.001	

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Finally, CFA was performed to test the measurement model using established fit indices [117,120,124,128,129]. Modifications were applied to the measurement model to enhance fit. The re-estimated model demonstrated that the model fit the data well (Table 11).

Table 11. Fit indices for the structural model of the overall dormitory satisfaction scale.

Fit Index	Model Values	Acceptable Values
CMIN/DF	1.754	≤5
RMSEA	0.041	≤0.10
CFI	0.999	≥0.80
TLI	0.995	≥0.80
IFI	0.999	≥0.80
RFI	0.988	≥0.80
NFI	0.998	≥0.80
SRMR	0.009	≤0.10

Examination of the CFA findings (Figure 6, Table 12) reveals that all items load onto a single factor with statistically significant factor loadings ($p<0.001$) exceeding 0.40 [110,120,124]. Additionally, the t-values for all items significantly exceeded the critical value of 1.96. These results demonstrate that the items successfully represent the latent construct and that the factor-item relationships within the measurement model are valid [124,130]. Consequently, the CFA results confirm the unidimensional factor structure and construct validity of the scale.

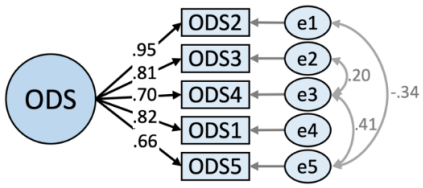

Figure 6. Single-factor CFA model of the overall dormitory satisfaction scale.

Table 12. Results related to the measurement model of the overall dormitory satisfaction scale.

Factors	Items	Factor Loadings	Standard Errors	t Values	p Values
F1 (ODS)	ODS2	0.947	-	-	-
	ODS3	0.811	0.039	22.681	***
	ODS4	0.701	0.044	17.640	***
	ODS1	0.822	0.037	23.161	***
	ODS5	0.663	0.050	14.808	***

***p<0.001

3.6. Data Analysis

To address the research questions identified in the study (RQ2–RQ9) and test the proposed theoretical models (Model 1 and Model 2), data analysis was conducted using AMOS (Analysis of Moment Structures) 23.0 software. Through this analysis, the proposed models were tested, and findings addressing all research questions were derived.

Structural Equation Modeling (SEM) was selected as the analytical method because it is a robust multivariate statistical technique that integrates the strengths of Confirmatory Factor Analysis (CFA) and Multiple Regression Analysis (MRA), allowing for the simultaneous analysis of complex causal relationships between observed and latent variables [110]. SEM is utilized to assess the theoretical adequacy of multiple interrelationships among factors within complex structural models [132]. This method enables researchers to test theoretical assumptions, elucidate complex variable structures, comprehensively evaluate direct and indirect interactions, and compare alternative models [120,130].

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Furthermore, unlike traditional multivariate analysis methods, SEM explicitly accounts for measurement errors, thereby yielding more accurate and reliable estimates [133].

4. Results

4.1. Results Related to Research Model 1

The model fit of the structural model established for Model 1 (factor-based model) was assessed by calculating the CMIN/DF, RMSEA, CFI, TLI, IFI, RFI, NFI, and SRMR indices [117,120,124,128,129], which are widely utilized in the literature. The calculated values fell within acceptable limits, indicating that the model demonstrates a good fit to the data (Table 13).

Table 13. Model fit values for research model-1.

Fit Index	Model Values	Acceptable Values
CMIN/DF	1.985	≤5
RMSEA	0.047	≤0.10
CFI	0.898	≥0.80
TLI	0.891	≥0.80
IFI	0.898	≥0.80
RFI	0.812	≥0.80
NFI	0.814	≥0.80
SRMR	0.063	≤0.10

In Structural Equation Modeling (SEM) and quantitative research, hypothesis acceptance is evaluated based on the p-value (significance) and the standardized path coefficient (β) (effect magnitude and direction). A p-value <0.05 indicates statistical significance, while lower values (p<0.01 and p<0.001) indicate higher levels of significance. The β value represents the strength of the effect (β<0.10: negligible; β≥0.10: weak; β≥0.30: moderate; β≥0.50: strong) and its direction (positive/negative) [120,124]. For mediation hypotheses, the Bootstrap Confidence Interval (BCI) is used instead of the p-value. The absence of zero (0) within the 95% Confidence Interval indicates that the mediating role is statistically significant [134,135].

Examination of the SEM findings for Model 1 (Table 14, Figure 7) reveals the following significant relationships:

- Flexibility of Use (FU) exerts a statistically significant, positive, and weak-to-moderate effect on Overall Dormitory Satisfaction (ODS) ($\beta = 0.168$, $p < 0.01$);
- Emotional and Psychological Atmosphere (EPA) exerts a statistically significant, positive, and moderate effect on ODS (ODS) ($\beta = 0.469$, $p < 0.001$);
- Overall Dormitory Satisfaction (ODS) has a statistically significant, positive, and strong effect on Place Attachment (PA) ($\beta = 0.615$, $p < 0.001$);
- ODS plays a significant mediating role (weak effect size) in the relationship between FU and PA (β=0.103) (0.019, 0.193);
- ODS plays a significant mediating role (moderate effect size) in the relationship between EPA and PA (β=0.289) (0.191, 0.409).

Conversely, the direct effects of Flexibility of Use (FU) and Emotional and Psychological Atmosphere (EPA) on Place Attachment (PA) were not found to be statistically significant. Furthermore, the remaining factors—Urban Location and Transportation (ULT), Spatial Organization and Accessibility (SOA), Comfort and Service Conditions (CSC), Safety and Structural Resilience (SSR), Facility Amenities (FA), Nearby Environment Conditions and Facilities (NEC), Visual (Aesthetic) Quality (VQ), and Socio-cultural Interaction and Solidarity (SIS)—did not yield statistically significant effects on either Overall Dormitory Satisfaction (ODS) or Place Attachment (PA).

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Table 14. SEM results for the research model-1.

Hypothesis	β	Standard Errors	*t*	*p*	Results
ULT→ ODS	0.077	0.094	1.231	0.218	Not supported
SOA→ ODS	0.047	0.143	0.673	0.501	Not supported
CSC→ ODS	0.026	0.151	0.258	0.796	Not supported
SSR→ ODS	0.045	0.089	0.682	0.495	Not supported
FA→ ODS	-0.092	0.086	-1.284	0.199	Not supported
NEC→ ODS	0.067	0.076	1.010	0.313	Not supported
FU→ ODS	0.168	0.074	2.746	0.006**	**Supported**
VQ→ ODS	0.080	0.088	1.019	0.308	Not supported
SIS→ ODS	-0.040	0.069	-0.728	0.466	Not supported
EPA→ ODS	0.469	0.091	6.322	***	**Supported**
ULT→ PA	0.022	0.068	0.368	0.713	Not supported
SOA→ PA	-0.017	0.104	-0.254	0.799	Not supported
CSC→ PA	0.074	0.110	0.777	0.437	Not supported
SSR→ PA	0.013	0.065	0.215	0.830	Not supported
FA→ PA	0.033	0.063	0.483	0.629	Not supported
NEC→ PA	0.067	0.055	1.087	0.277	Not supported
FU→ PA	0.007	0.055	0.114	0.909	Not supported
VQ→ PA	0.130	0.064	1.765	0.078	Not supported
SIS→ PA	0.045	0.050	0.885	0.376	Not supported
EPA→ PA	-0.062	0.069	-0.864	0.388	Not supported
ODS→ PA	0.615	0.047	10.071	***	**Supported**
ULT→ ODS→ PA	0.047	Confidence Interval (-0.038, 0.154)			Not supported
SOA→ ODS→ PA	0.029	Confidence Interval (-0.074, 0.145)			Not supported
CSC→ ODS→ PA	0.016	Confidence Interval (-0.161, 0.198)			Not supported
SSR→ ODS→ PA	0.028	Confidence Interval (-0.061, 0.140)			Not supported
FA→ ODS→ PA	-0.057	Confidence Interval (-0.174, 0.044)			Not supported
NEC→ ODS→ PA	0.041	Confidence Interval (-0.049, 0.119)			Not supported
FU→ ODS→ PA	0.103	Confidence Interval (0.019, 0.193)			**Supported**
VQ→ ODS→ PA	0.049	Confidence Interval (-0.064, 0.161)			Not supported
SIS→ ODS→ PA	-0.024	Confidence Interval (-0.105, 0.042)			Not supported
EPA→ ODS→ PA	0.289	Confidence Interval (0.191, 0.409)			**Supported**

**p<0.01; ***p<0.001

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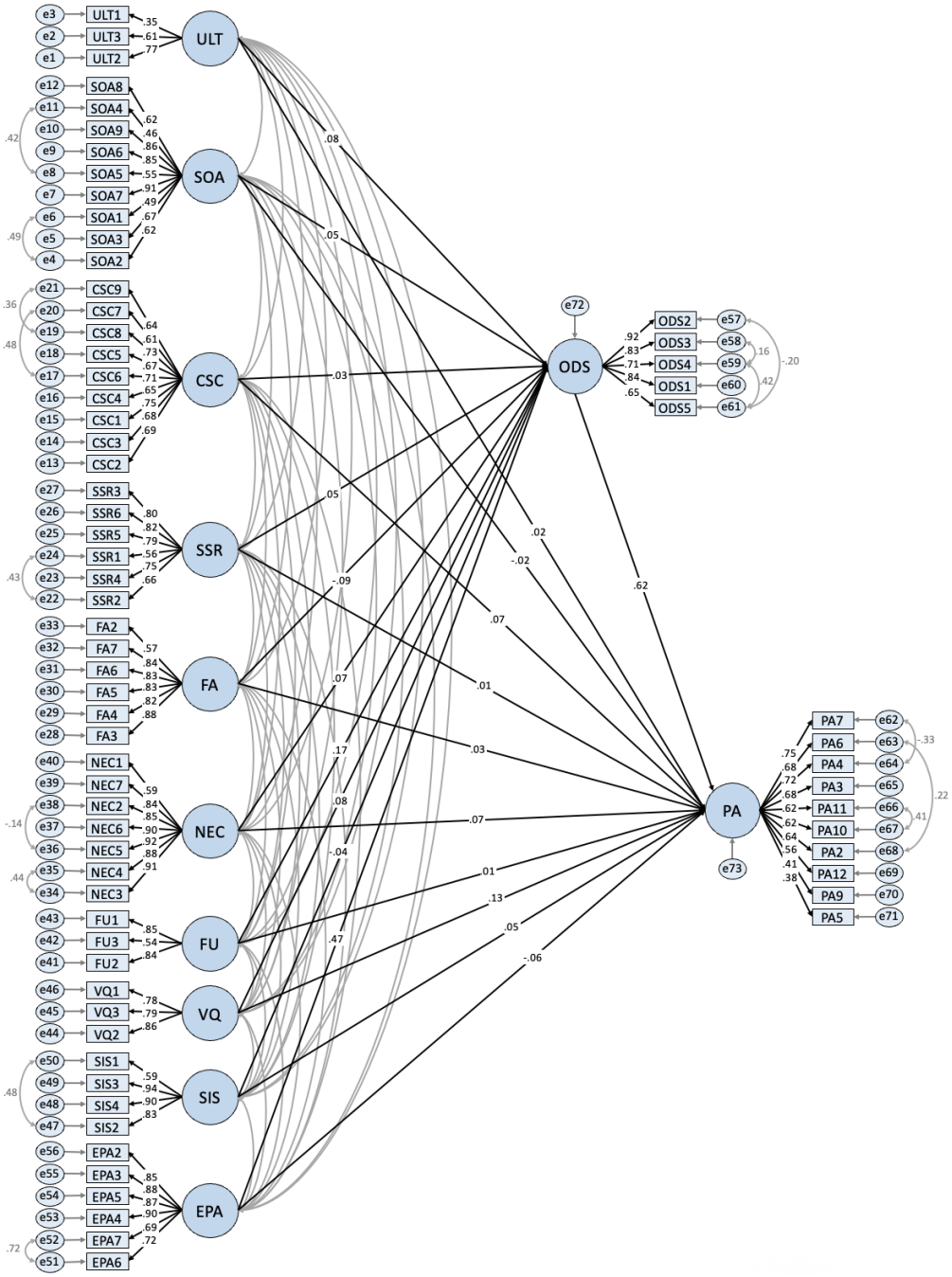

Figure 7. Research model-1.

4.2. Results Related to Research Model 2

The model fit of the structural model established for Model 2 (holistic model) was assessed by calculating the CMIN/DF, RMSEA, CFI, TLI, IFI, RFI, NFI, and SRMR indices [117,120,124,128,129], which are widely utilized in the literature. The calculated values fell within acceptable limits, indicating that the model demonstrates a good fit to the data (Table 15).

Table 15. Model fit values for research model-2.

Fit Index	Model Values	Acceptable Values
CMIN/DF	2.105	≤5
RMSEA	0.050	≤0.10
CFI	0.882	≥0.80
TLI	0.877	≥0.80

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IFI	0.883	≥0.80
RFI	0.807	≥0.80
NFI	0.809	≥0.80
SRMR	0.076	≤0.10

Examination of the SEM findings for Model 2 (Table 16, Figure 8) reveals the following relationships:

- Spatial Quality Satisfaction (SQS), as a holistic construct, exerts a statistically significant, positive, and strong effect on Overall Dormitory Satisfaction (ODS) ($\beta = 0.654$, $p < 0.001$).
- SQS exerts a statistically significant, positive, and moderate effect on Place Attachment (PA) ($\beta = 0.278$, $p < 0.001$).
- ODS plays a significant mediating role (moderate effect size) in the relationship between SQS and PA (β=0.370) (0.289, 0.460).

Table 16. SEM results for the research model-2

Hypothesis	β	Standard Errors	*t*	*p*	Results
SQS→ ODS	0.654	0.260	7.489	***	**Supported**
SQS→ PA	0.278	0.146	4.391	***	**Supported**
SQS→ ODS→ PA	0.370	Confidence Interval (0.289, 0.460)			**Supported**

***p<0.001

According to the measurement model findings for Model 2 (Table 17, Figure 8), the factor loadings (λ) indicate the level at which each sub-dimension represents the overall Spatial Quality Satisfaction (SQS):

- Urban Location and Transportation (ULT): Weak-to-moderate representation (λ= 0.48).
- Spatial Organization and Accessibility (SOA): Strong representation (λ= 0.62).
- Comfort and Service Conditions (CSC): Very strong representation (λ= 0.80).
- Safety and Structural Resilience (SSR): Strong representation (λ= 0.66).
- Facility Amenities (FA): Very strong representation (λ= 0.77).
- Nearby Environmental Conditions and Facilities (NEC): Strong representation (λ= 0.62).
- Flexibility of Use (FU): Moderate-to-strong representation (λ= 0.58).
- Visual (Aesthetic) Quality (VQ): Very strong representation (λ= 0.83).
- Socio-cultural Interaction and Solidarity (SIS): Strong representation (λ= 0.63).
- Emotional and Psychological Atmosphere (EPA): Very strong representation (λ= 0.80).

These results clarify the relative contribution of each factor to the overall perception of spatial quality satisfaction.

Table 17. Representation levels of the factors constituting spatial quality satisfaction.

Factors	Factor Loading (λ)	Representation Level
ULT	0.48	Weak-moderate
SOA	0.62	Strong
CSC	0.80	Very strong
SSR	0.66	Strong
FA	0.77	Very strong
NEC	0.62	Strong
FU	0.58	Moderate-strong
VQ	0.83	Very strong
SIS	0.63	Strong
EPA	0.80	Very strong

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In this context, the factors constituting Spatial Quality Satisfaction in student dormitories are ranked from highest to lowest based on their contribution to the overall SQS construct as follows:

Visual (Aesthetic) Quality (VQ) > Comfort and Service Conditions (CSC) = Emotional and Psychological Atmosphere (EPA) > Facility Amenities (FA) > Safety and Structural Resilience (SSR) > Socio-cultural Interaction and Solidarity (SIS) > Spatial Organization and Accessibility (SOA) = Nearby Environmental Conditions and Facilities (NEC) > Flexibility of Use (FU) > Urban Location and Transportation (ULT).

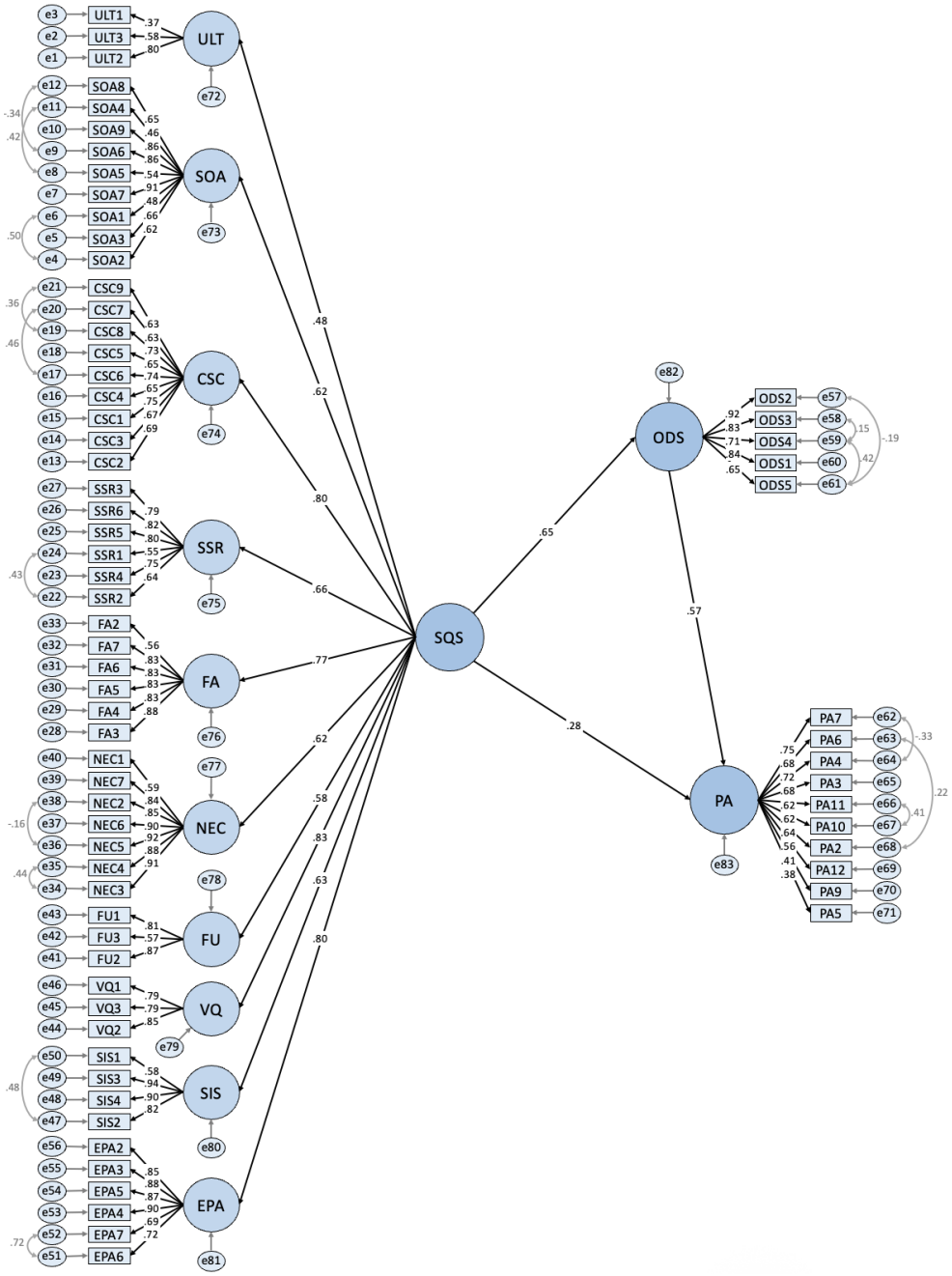

Figure 8. Research model-2.

5. Discussion

In Model 1, proposed and tested within the scope of this study, Spatial Quality Satisfaction (SQS) in student dormitories was conceptualized as a multidimensional structure consisting of ten distinct components: Urban Location and Transportation (ULT), Spatial Organization and Accessibility (SOA), Comfort and Service Conditions (CSC), Safety and Structural Resilience (SSR), Facility

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Amenities (FA), Nearby Environmental Conditions and Facilities (NEC), Flexibility of Use (FU), Visual (Aesthetic) Quality (VQ), Socio-cultural Interaction and Solidarity (SIS), and Emotional and Psychological Atmosphere (EPA). Within this framework, Model 1 examined the individual effects of these ten factors—while accounting for their interrelationships—on Overall Dormitory Satisfaction (ODS) and Place Attachment (PA). Additionally, the model tested both the direct effect of ODS on PA and the mediating role of ODS in the relationship between each SQS factor and PA.

The findings from Model 1 indicate that none of the ten factors constituting SQS exert a statistically significant direct effect on PA when considered individually. Moreover, eight of these factors (ULT, SOA, CSC, SSR, FA, NEC, VQ, and SIS) do not have a statistically significant direct effect on ODS on their own. In contrast, Emotional and Psychological Atmosphere (EPA) and Flexibility of Use (FU) emerge as the only factors exerting a direct effect on ODS and an indirect effect on PA via ODS. This implies that most SQS factors in student dormitories are not independently capable of producing meaningful changes in overall satisfaction or attachment. Rather, EPA and FU function as the most decisive determinants at the individual level. These findings suggest that when factor-specific improvements are considered, priority should be given to enhancing the emotional–psychological atmosphere and flexibility of use within dormitory spaces.

Nevertheless, the results of Model 1 also demonstrate that ODS exerts a statistically significant, positive, and strong effect on PA. This finding corroborates previous studies in the literature [29,30,38–40], which report that satisfaction with residential environments—such as student dormitories, student housing, and hostels—contributes positively and meaningfully to individuals' place attachment.

Model 2, the holistic model proposed and tested in this study, differs fundamentally from Model 1 in that the ten factors of SQS are not examined separately. Instead, they are synthesized into a single, overarching Spatial Quality Satisfaction (SQS) construct. Within this framework, Model 2 assesses the direct effects of holistic SQS on ODS and PA, alongside the mediating role of ODS. Additionally, the model evaluates the degree to which each factor contributes to the holistic perception of SQS.

The findings from Model 2 reveal that nine of the ten factors (SOA, CSC, SSR, FA, NEC, FU, VQ, SIS, and EPA) represent the overall perception of SQS at strong or very strong levels. Conversely, Urban Location and Transportation (ULT) represents the holistic perception at a weak-to-moderate level. This indicates that the multidimensional SQS structure developed in this study is both robust and reliable, while also suggesting that the contribution of urban location is comparatively limited in shaping users' overall perception of spatial quality in student dormitories.

Furthermore, Model 2 demonstrates that SQS as a whole exerts a statistically significant, positive, and direct effect on both ODS and PA, with ODS playing a significant mediating role. These findings are supported by (i) studies showing that perceived spatial quality significantly influences place attachment [70–74]; (ii) environmental psychology research indicating that place satisfaction positively affects place attachment [38,40–43]; and (iii) the work of Khozaei et al. [30], highlighting that fulfilled preferences in student dormitories positively influence both satisfaction and attachment, with satisfaction serving as a key mediator.

Crucially, a noteworthy result emerges when comparing the findings of Model 1 and Model 2. While the individual factors of SQS do not independently exert decisive effects on ODS or PA (Model 1), the holistic perception of SQS formed by these factors collectively proves to be the primary predictor of both outcome variables (Model 2). This suggests that, in human cognitive and emotional processing, the components of spatial quality are not evaluated in isolation but are perceived collectively as an integrated experience. Accordingly, SQS should be understood not merely as a factor-based process, but as a holistic phenomenon. In this respect, the concept resonates with both Gestalt theory in perception psychology and the synergy principle in systems theory, which emphasize that "the whole is greater than the sum of its parts" [136–138].

Finally, findings from both models consistently demonstrate that Overall Dormitory Satisfaction functions as a significant mediating variable in the relationship between Spatial Quality Satisfaction and Place Attachment. This result validates the inclusion of ODS as a mediating construct in the

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theoretical models and underscores its critical role in explaining how spatial quality perceptions translate into stronger emotional bonds with place.

6. Conclusion

6.1. Summary of Key Findings

The findings of this study reveal that most factors constituting Spatial Quality Satisfaction (SQS) in student dormitories do not significantly influence Overall Dormitory Satisfaction (ODS) or Place Attachment (PA) when considered individually. Within this framework, Emotional and Psychological Atmosphere (EPA) and Flexibility of Use (FU) emerge as the primary determinants, as they directly affect ODS and indirectly influence PA through ODS.

The results further demonstrate that ODS exerts a statistically significant, positive, and strong effect on PA, underscoring its critical role in the development of students' emotional bonds with dormitory environments.

In contrast to the factor-based approach, the findings indicate that SQS, when considered as a holistic construct, exerts a robust, direct, and significant effect on both ODS and PA. Moreover, ODS plays a highly significant mediating role in the relationship between holistic SQS and PA.

Collectively, these findings suggest that improvements in student dormitories aimed at enhancing overall satisfaction and place attachment are more effectively achieved through a holistic spatial quality approach, rather than through interventions focusing on isolated or fragmented spatial factors.

6.2. Original Value/Contribution

This study offers distinct value and makes significant contributions across three main dimensions: theoretical, methodological, and practical.

From a theoretical perspective, the study's originality lies in its pioneering examination of Spatial Quality Satisfaction (SQS), Overall Dormitory Satisfaction (ODS), and Place Attachment (PA) within a single, integrated framework focused on state-run higher education dormitories. By testing the direct and indirect relationships among these variables through both factor-based and holistic approaches, the study addresses and bridges a critical theoretical gap in the literature, where these concepts have rarely been examined together in such a systematic and comprehensive manner. Moreover, the study strengthens its theoretical contribution by clearly identifying the specific components constituting SQS and empirically demonstrating the extent to which each component represents the holistic perception of spatial quality.

From a methodological perspective, the study is distinguished by its comprehensive, multi-stage, and systematic research design, spanning from theoretical model development to scale adaptation and advanced multivariate analyses using Structural Equation Modeling (SEM). Within this framework, the Spatial Quality Satisfaction Scale—developed specifically for the dormitory context—along with the adapted ODS and PA scales, were rigorously validated through expert evaluation, pilot testing, exploratory and confirmatory factor analyses, and reliability assessments. These steps provided robust measurement instruments suitable for SEM applications. Furthermore, the use of stratified sampling ensured a representative sample covering all state-run student dormitories in the Central District of Kırklareli, and the empirical testing of dual theoretical models (factor-based and holistic) further enhances the methodological rigor and originality of the research.

From a practical standpoint, the study contributes original models, validated scales, and conceptual insights to the fields of spatial quality, place attachment, and human–environment interaction. By quantifying SQS, ODS, and PA within student dormitories, the study provides a strategic data source for decision-makers, architects, and administrators. Furthermore, by statistically demonstrating both the individual and holistic effects of spatial quality factors on place attachment—alongside the mediating role of overall satisfaction—the study offers an applicable and evidence-

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based framework to guide dormitory management policies, architectural design processes, and interventions aimed at enhancing student well-being.

6.3. Limitations and Recommendations

This study was designed based on specific variables and a sample group consisting of 450 participants residing in state-run higher education dormitories in the Central District of Kırklareli. Due to sample size constraints, the dataset could not be divided for separate analyses; consequently, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were conducted on the same sample. This constraint limits the generalizability of the findings. Therefore, the results should be interpreted within the specific context of the current study. To strengthen the construct validity and generalizability of the proposed models, future research should employ split-sample validation or cross-validation tests with larger sample groups.

Another limitation concerns the operationalization of the place attachment concept. There is currently no consensus in the literature regarding whether place attachment should be approached as a unidimensional or multidimensional construct. For instance, Lewicka [37] treats it as a single-factor structure; Williams and Vaske [48] define it through two factors (place identity and place dependence); while Chen et al. [40] propose four factors (place identity, place dependence, emotional attachment, and social bond). In this study, considering the comprehensive structure of the independent variable (Spatial Quality Satisfaction), which consists of ten factors, and the inclusion of a mediating variable, place attachment was treated as a single-factor structure to ensure model parsimony. This choice was further supported statistically by the EFA, CFA, and reliability analyses conducted herein. Future studies are encouraged to conceptualize place attachment as a multidimensional structure to reveal the unique effects of specific spatial quality components on different sub-dimensions of place attachment (e.g., place identity, place dependence), thereby providing a more in-depth perspective to the literature.

While the findings provide a robust framework, the relative importance of the factors constituting spatial quality satisfaction may vary according to the physical, functional, social, and cultural characteristics of different dormitories. Therefore, it is crucial to test the proposed models in dormitories with diverse characteristics across different geographical regions to facilitate comparative analysis. Furthermore, validating the developed and adapted scales not only in dormitory structures but also in various spatial contexts—such as similar communal living spaces or different types of accommodation—will significantly contribute to the external validity of the model.

Finally, this study relied exclusively on quantitative research methods. In future inquiries, adopting a mixed-methods approach—supporting quantitative data with qualitative methods such as focus group discussions and in-depth interviews—would allow for a more comprehensive and nuanced understanding of users' perceptions regarding spatial quality satisfaction, overall dormitory satisfaction, and place attachment, extending beyond numerical data.

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Abbreviations

The following abbreviations are used in this manuscript:

SQS	Spatial quality satisfaction
PA	Place attachment
ODS	Overall dormitory satisfaction
ULT	Urban location and transportation
SOA	Spatial organization and accessibility
CSC	Comfort and service conditions
SSR	Safety and structural resilience
FA	Facility amenities
NEC	Nearby environmental conditions and facilities
FU	Flexibility of use
VQ	Visual (aesthetic) quality
SIS	Socio-cultural interaction and solidarity
EPA	Emotional and psychological atmosphere
EFA	Exploratory factor analysis
CFA	Confirmatory factor analysis
SEM	Structural equation modeling
RQ	Research question
MoYS	Ministry of Youth and Sports
MS	Microsoft
SPSS	Statistical package for social sciences
AMOS	Analysis of moment structures
KMO	Kaiser-Meyer-Olkin
CMIN/DF	Chi-square to degrees of freedom ratio
RMSEA	Root mean square error of approximation
CFI	Comparative fit index
TLI	Tucker-Lewis index
IFI	Incremental fit index
RFI	Relative fit index
NFI	Normed fit index
SRMR	Standardized root mean square residual
MRA	Multiple regression analysis

Appendix A

Table A1. The "Participant Information Section" in the survey form.

Participant Information Questions
1- What is your gender?
( ) Female ( ) Male
2- What is your marital status?
( ) Single ( ) Married
3- How old are you?
( ) 17 ( ) 18 ( ) 19 ( ) 20 ( ) 21 ( ) 22 ( ) 23 ( ) 24 ( ) 25 and over
4- Which department are you studying in?
(Please write: ……)
5- What is your academic year level?
( ) Preparatory class ( ) 1st Year ( ) 2nd Year ( ) 3rd Year ( ) 4th Year
6- What is the degree level of your department?
( ) Associate degree ( ) Bachelor's degree ( ) Postgraduate degree
7- Which campus is your department based in?
( ) Kayalı ( ) Kavaklı ( ) Karahıdır ( ) Other

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8- In which city does your family reside?
(Please write: ……)

9- Which dormitory do you reside in?
( ) Evlad-ı Fatihan Female Student Dormitory
( ) Hundi Hatun Female Student Dormitory
( ) Ahmet Cevdet Pasha Male Student Dormitory
( ) Şemseddin Sami Male Student Dormitory
( ) Kırklareli Male Student Dormitory

10- How long have you been living in dormitory?
( ) 1-12 months ( ) 13-24 months ( ) 25-36 months
( ) 37-48 months ( ) 49-60 months ( ) 61 months and over

11- What is the capacity of your dormitory room?
( ) 1 ( ) 2 ( ) 3 ( ) 4

12- On which floor is your dormitory room located?
( ) -1st ( ) Ground Floor ( ) 1st ( ) 2nd ( ) 3rd ( ) 4th ( ) 5th

Table A2. The "Student Dormitories Place Attachment Scale" in the survey form.

	Place Attachment (PA)	SD	D	N	A	SA
PA1	I know this dormitory very well.	( )	( )	( )	( )	( )
PA2	I defend it when somebody criticizes it.	( )	( )	( )	( )	( )
PA3	I miss it when I am not here.	( )	( )	( )	( )	( )
PA4	I don't like this dormitory.	( )	( )	( )	( )	( )
PA5	I feel secure in this dormitory.	( )	( )	( )	( )	( )
PA6	I am proud of this dormitory.	( )	( )	( )	( )	( )
PA7	It is a part of myself.	( )	( )	( )	( )	( )
PA8	I have no influence on its affairs.	( )	( )	( )	( )	( )
PA9	I want to be involved in what is going on here.	( )	( )	( )	( )	( )
PA10	I leave this dormitory with pleasure.	( )	( )	( )	( )	( )
PA11	I would not like to move out from here.	( )	( )	( )	( )	( )
PA12	I am rooted here.	( )	( )	( )	( )	( )

SD: Strongly disagree; D: Disagree; N: Neither agree nor disagree; A: Agree; SA: Strongly agree

Table A3. The "Student Dormitories Spatial Quality Satisfaction Scale" in the survey form.

	Spatial Quality Satisfaction (SQS)	SD	D	N	A	SA
	1-Urban Location and Transportation (ULT)					
ULT1	It is easy to reach my university campus from the dormitory (on foot, by public transport, or by bicycle).	( )	( )	( )	( )	( )
ULT2	It is easy to reach the city center from the dormitory (on foot, by public transport, or by bicycle.	( )	( )	( )	( )	( )
ULT3	I am satisfied with the dormitory's location within the city.	( )	( )	( )	( )	( )
	2-Spatial Organization and Accessibility (SOA)					
SOA1	It is easy to access other spaces of the dormitory from my room.	( )	( )	( )	( )	( )
SOA2	I am satisfied with the location of the spaces within the dormitory complex.	( )	( )	( )	( )	( )
SOA3	I can move around easily within the dormitory spaces.	( )	( )	( )	( )	( )
SOA4	The dormitory spaces are accessible for individuals with physical disabilities.	( )	( )	( )	( )	( )
SOA5	I think the locations of the dormitory entrances (complex entrance, building entrances) are appropriate.	( )	( )	( )	( )	( )
SOA6	I am satisfied with the size (height, width, depth) of the spaces in the dormitory.	( )	( )	( )	( )	( )

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SOA7	I am satisfied with the shapes/forms of spaces in the dormitory.	( )	( )	( )	( )	( )
SOA8	I am satisfied with the orientation of spaces in the dormitory.	( )	( )	( )	( )	( )
SOA9	I am satisfied with the interior layout/arrangement of spaces in the dormitory.	( )	( )	( )	( )	( )
	3-Comfort and Service Conditions (CSC)					
CSC1	The dormitory spaces generally have fresh air.	( )	( )	( )	( )	( )
CSC2	The dormitory spaces generally do not have physical problems such as humidity, dampness, water leakage, or cracks.	( )	( )	( )	( )	( )
CSC3	The dormitory spaces provide thermal comfort in both cold and hot condition.	( )	( )	( )	( )	( )
CSC4	The dormitory spaces are generally quiet / free from noise.	( )	( )	( )	( )	( )
CSC5	The lighting (natural light, lamps, bulbs, etc.) in the dormitory spaces is sufficient.	( )	( )	( )	( )	( )
CSC6	I am satisfied with the general cleanliness/hygiene of the dormitory spaces.	( )	( )	( )	( )	( )
CSC7	The number/capacity of trash bins in the dormitory spaces is sufficient.	( )	( )	( )	( )	( )
CSC8	I am satisfied with the maintenance and repair of the dormitory spaces.	( )	( )	( )	( )	( )
CSC9	I am satisfied with the general operational/service conditions of the dormitory.	( )	( )	( )	( )	( )
	4-Safety and Structural Resilience (SSR)					
SSR1	The dormitory entrances and exits (complex, building) are under security control.	( )	( )	( )	( )	( )
SSR2	The dormitory spaces are secure against theft.	( )	( )	( )	( )	( )
SSR3	The dormitory spaces are safe from physical accidents (falls, slips, collisions, electric shocks, etc.).	( )	( )	( )	( )	( )
SSR4	I think the dormitory is generally safe from animal attacks.	( )	( )	( )	( )	( )
SSR5	I think the dormitory is generally safe from fire incidents.	( )	( )	( )	( )	( )
SSR6	I think the dormitory is generally resilient to natural disasters (earthquake, flood, storm, lightning).	( )	( )	( )	( )	( )
	5-Facility Amenities (FA)					
FA1	The interior furnishings and small appliance amenities in the dormitory spaces are sufficient.	( )	( )	( )	( )	( )
FA2	The vehicle (car, motorcycle, bicycle, etc.) parking facilities in the dormitory are sufficient.	( )	( )	( )	( )	( )
FA3	The socio-cultural facilities in the dormitory are sufficient.	( )	( )	( )	( )	( )
FA4	The relaxation/lounge facilities in the dormitory are sufficient.	( )	( )	( )	( )	( )
FA5	The entertainment/recreation facilities in the dormitory are sufficient.	( )	( )	( )	( )	( )
FA6	The study facilities in the dormitory are sufficient.	( )	( )	( )	( )	( )
FA7	The daily life (cooking, storage, laundry, shopping, pet care, smoking, etc.) and service (canteen, infirmary, hairdresser, tailor, elevator, etc.) facilities in the dormitory are sufficient.	( )	( )	( )	( )	( )
FA8	Infrastructure and communication facilities in the dormitory are sufficient.	( )	( )	( )	( )	( )
	6-Nearby Environmental Conditions and Facilities (NEC)					
NEC1	I am satisfied with the natural and built physical conditions in the nearby environments of the dormitory complex.	( )	( )	( )	( )	( )

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NEC2	I am satisfied with the socio-cultural conditions in the nearby environments of the dormitory complex.	( )	( )	( )	( )	( )
NEC3	I am satisfied with the commercial and employment facilities in the nearby environments of the dormitory complex.	( )	( )	( )	( )	( )
NEC4	I am satisfied with the healthcare facilities in the nearby environments of the dormitory complex.	( )	( )	( )	( )	( )
NEC5	I am satisfied with the socialization facilities in the nearby environments of the dormitory complex.	( )	( )	( )	( )	( )
NEC6	I am satisfied with the entertainment and recreation facilities in the nearby environments of the dormitory complex.	( )	( )	( )	( )	( )
NEC7	I am satisfied with the educational facilities in the nearby environments of the dormitory complex.	( )	( )	( )	( )	( )
	7-Flexibility of Use (FU)					
FU1	I am able to personalize and decorate in the dormitory spaces according to my preferences.	( )	( )	( )	( )	( )
FU2	I am able to control and adjust the comfort conditions (heating, cooling, ventilation, lighting, noise) in the dormitory spaces according to my preferences.	( )	( )	( )	( )	( )
FU3	I am able to comfortably perform various activities (studying, socializing, eating, etc.) in my dormitory room besides sleeping.	( )	( )	( )	( )	( )
	8-Visual (Aesthetic) Quality (VQ)					
VQ1	The dormitory spaces are visually appealing (in terms of color, texture, style, etc.).	( )	( )	( )	( )	( )
VQ2	The view from the windows of the dormitory spaces is pleasant and attractive.	( )	( )	( )	( )	( )
VQ3	The overall appearance of the dormitory complex is in harmony with the surrounding environment.	( )	( )	( )	( )	( )
	9-Socio-cultural Interaction and Solidarity (SIS)					
SIS1	I usually engage in social interactions with others in the dormitory spaces according to my own preference.	( )	( )	( )	( )	( )
SIS2	I am satisfied with the level of social interaction in the dormitory spaces.	( )	( )	( )	( )	( )
SIS3	I am satisfied with the overall environment of social solidarity in the dormitory.	( )	( )	( )	( )	( )
SIS4	I am satisfied with the overall environment of cultural interaction in the dormitory.	( )	( )	( )	( )	( )
	10-Emotional and Psychological Atmosphere (EPA)					
EPA1	I am satisfied with the level of privacy in the dormitory spaces.	( )	( )	( )	( )	( )
EPA2	I generally feel peaceful in the dormitory spaces.	( )	( )	( )	( )	( )
EPA3	I generally feel free in the dormitory spaces.	( )	( )	( )	( )	( )
EPA4	I generally feel happy in the dormitory spaces.	( )	( )	( )	( )	( )
EPA5	I generally perceive the dormitory spaces as intimate.	( )	( )	( )	( )	( )
EPA6	The dormitory spaces generally have a positive effect on my mood.	( )	( )	( )	( )	( )
EPA7	The dormitory spaces generally have a positive effect on my quality of life	( )	( )	( )	( )	( )

SD: Strongly disagree; D: Disagree; N: Neither agree nor disagree; A: Agree; SA: Strongly agree

Table A4. The "Overall Dormitory Satisfaction Scale" in the survey form.

Overall Dormitory Satisfaction (ODS)	**SD**	**D**	**N**	**A**	**SA**

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ODS1	Overall, I am satisfied with this dormitory.	( )	( )	( )	( )	( )
ODS2	I am happy to stay in this dormitory.	( )	( )	( )	( )	( )
ODS3	I will recommend that my friends stay in this dormitory.	( )	( )	( )	( )	( )
ODS4	I would like to stay in this dormitory next semester as well.	( )	( )	( )	( )	( )
ODS5	I would not prefer moving to another dormitory.	( )	( )	( )	( )	( )

SD: Strongly disagree; D: Disagree; N: Neither agree nor disagree; A: Agree; SA: Strongly agree

Appendix B

Table B1. Descriptive information regarding the 450 participants in the survey.

Variables	Sub-Variables	Number	%
Gender	Female	275	61.1
	Male	175	38.9
Marital Status	Single	450	100.0
Age	18	52	11.6
	19	63	14.0
	20	114	25.3
	21	112	24.9
	22	56	12.4
	23 and above	53	11.8
Field of Study	Science, Engineering, and Architecture	62	13.8
	Social and Humanities Sciences	127	28.2
	Health Sciences	148	32.9
	Economics and Administrative Sciences	39	8.7
	Technical Programs	32	7.1
	Transportation and Service Sciences	42	9.3
Year of Study	Preparatory and 1st Year	204	45.3
	2nd Year	156	34.7
	3rd and 4th Year	90	20.0
Degree Level	Associate degree	118	26.2
	Bachelor's degree	332	73.8
Campus Location	Kayalı	332	73.8
	Kavaklı	83	18.4
	Karahıdır	35	7.8
Region Where the Family Lives	Marmara Region	85	18.9
	Istanbul Province	159	35.3
	Thrace Region	73	16.2
	Other	133	29.6
Dormitory	Evlad-ı Fatihan Female Student Dormitory	146	32.4
	Hundi Hatun Female Student Dormitory	129	28.7
	Ahmet Cevdet Pasha Male Dormitory	97	21.6
	Şemseddin Sami Male Student Dormitory	40	8.9
	Kırklareli Male Student Dormitory	38	8.4
Duration of Residence	1-12 months	200	44.4
	13-24 months	141	31.3
	25-36 months	62	13.8
	37 months and over	47	10.5
Number of Roommates	4	450	100.0
Floor Level	Ground floor	112	24.9
	1st floor	93	20.6
	2nd floor	111	24.7
	3rd and 4th floors	134	29.8

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