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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 collected from 450 students residing in five state-run dormitories in Kırklareli, Turkey, via three 5-point Likert-type scales (validated by expert review and a pilot study), were analyzed using structural equation modeling, following exploratory factor analysis, confirmatory factor analysis, and Cronbach's alpha validations. Findings from the factor-based Model 1 indicate that eight of the ten 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, this model reveals that ODS has a strong and positive effect on PA. Results from the holistic Model 2 demonstrate that SQS, when treated as an integrated construct, has a robust and significant effect on both ODS and PA, with ODS playing a significant mediating role in the relationship between SQS and PA. Overall, the findings suggest that students perceive spatial quality as a whole. Therefore, improving student dormitories through a holistic SQS approach is more effective in enhancing PA and ODS than interventions focused 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

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1. Introduction

Beyond being a geometric volume defined by physical boundaries, space is a dynamic living area that gains meaning through physical and sensory experiences, where perceptual and imaginative layers intertwine [1–6]. Space, which is a whole consisting of relationships and forms, continues to exist not only with physical boundaries but also with the human being who gives it meaning [7,8]. In this context, space constitutes an inseparable part of the human being [9–12]. In this process of coexistence, space transcends its physical characteristics and, through lived experiences and social values, transforms from a geometric volume into a "place" that carries identity and meaning [4,5,8,9,13–15]. 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].

Place attachment is of great importance in terms of humans and space, and is not limited to a single space or person [19,21]. Place attachment can develop between an individual and any type of space [19,25]. In recent years, parallel to the increase in the number of university and higher education students worldwide, student dormitories [26–28], which are rapidly increasing in both number and capacity, are also among these spaces [29,30]. Student dormitories, which are important spaces for students in terms of accommodation, living, learning, and social interaction [31–33] and the students who experience the dormitory as users, the absence or deficiency of place attachment leads to many negative consequences such as isolation, alienation, lack of self-confidence, failure, lack of motivation, unhappiness, mental health problems, and the desire to leave the dormitory [34–36]. Therefore, the 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]. Furthermore, although the direct relationship between satisfaction and place attachment has been empirically investigated in recent years, these studies primarily concentrate on broader urban scales, such as public open spaces, neighborhoods, and rural-urban contexts [38,40,43]. Current empirical studies examining student dormitories largely focus on general residential satisfaction, environmental features, or broad institutional belonging [26,27,33,35]. The limited scope of existing studies in the literature and the inconsistent findings regarding the relationship between place attachment and satisfaction 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;
- 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?
- 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 perception of 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. Section 2 presents the sub-topics pivotal to the theoretical model—place attachment, spatial quality satisfaction, and their interrelationships—based on a literature review. Section 3 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). Section 4 reports the findings obtained from the SEM analysis used to test the research models. Section 5 evaluates these findings in the context of existing literature. Section 6 presents the final conclusions of the study, its original value, limitations, and recommendations for institutions and individuals conducting research on the topics examined/discussed in the study.

2. Theoretical Framework

2.1. Place Attachment

There is a multidimensional, multilayered, and inherently mutual interaction between humans and space [5,9,15]. This interaction, shaped 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 are based on research conducted in various disciplines such as environmental psychology, architecture, design, and planning since the 1960s. Evaluated within the framework of the interaction between human beings and space, this concept is among the most difficult concepts to define

in the literature [20]. Therefore, it should be defined as a multidimensional concept that encompasses the various definitions of place attachment in the existing literature. Accordingly, place attachment can fundamentally be expressed as a multifaceted emotional, cognitive, and tactile bond that deepens over time, which individuals form with spaces that meet their basic needs and provide feelings such as comfort and belonging [14,19,21,23,46,47].

Essentially, this multidimensional bond is rooted in the dynamics of human–space interaction. The background of this relationship has also been explored in disciplines that focus on people's cognitive and emotional responses to the built environment. For example, neuroarchitecture research shows that the physical characteristics of spaces can influence users' perceptions and evoke emotional responses, thereby connecting individuals to spaces in a meaningful and profound way [48,49]. Biophilic design studies emphasize the importance of experiencing nature, revealing that integrating nature-based elements into architecture increases users' well-being and emotional attachment to the space [50–54]. All these contemporary approaches demonstrate that place attachment is not solely influenced by the physical characteristics of a space but is also a multidimensional bond shaped by perceptual, experiential, and psychological processes. Therefore, in the context of student dormitories, fostering students' emotional attachment requires a holistic design approach that prioritizes their psychological well-being and stress reduction—areas where neuroarchitecture and biophilic concepts provide valuable supporting frameworks.

The place attachment, formed by emotional, functional, and conceptual bonds between human beings and space, is a fluid, variable, and multifaceted process rather than a static state [10,55]. For this reason, place attachment can manifest at different levels and in different forms [19,21].

Regardless of the level and form in which it occurs, place attachment is a fundamental need inherent in human nature and is of particular importance [22–24]. Place attachment, which is at the center of human–space interaction, has many benefits for both space and humans. These benefits can be summarized as follows [21,23,47]:

- 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 space from a formal to a sincere atmosphere.
- 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.

The place attachment is not limited to a single scale or space [19,21]. Place attachment can develop between individuals and places at various scales, such as rooms, houses, buildings, streets, neighborhoods, districts, cities, and countries [19,25]. In recent years, as the number of universities and students worldwide has increased, student dormitories [26–28], which have shown rapid growth in both numbers and capacity, are also among the spaces to which people can feel attached [29,30]. Student dormitories are important for young adults in terms of accommodation, living, learning, social communication, and interaction [31–33]. Students staying in dormitories may encounter experiences they have not had at home and may experience emotional difficulties as they try to adapt to a new life [34,56]. At this point, place attachment plays an important role in reducing the impact of such negative experiences by making students feel at home, improving their quality of life and mental health, increasing their academic success, and increasing their interaction

with the environment [47,57,58]. For this reason, developing place attachment between students and the dormitory is essential.

2.2. Spatial Quality Satisfaction

The concept of quality, which implies "level of excellence" or "superior characteristics," is closely related to the notion of value. It is a multidimensional, multifaceted, and subjective concept that is perceived and defined in different ways depending on the context [59–61]. For this reason, there is no standard definition of the concept of "quality" that is accepted by everyone, as it is generally used in various fields to express that something (product, project, physical intervention, etc.) is "better" or "worse" [62,63]. The concept of "spatial quality" is also difficult to define easily, because it is a phenomenon that is evaluated in different dimensions and meanings in various disciplines [64–66].

In general, the concept of spatial quality, which expresses the extent to which the physical, social, psychological, esthetic, safety, and technical characteristics of a space meet specified requirements [67], has been approached by researchers as a structure comprising various dimensions. For example, Greene [68] approaches spatial quality as a structure consisting of the dimensions of function, order, identity, and appeal/attraction; Van der Voordt and Van Wegen [66] approach it as a structure consisting of the dimensions of functional quality, esthetic quality, technical quality, and economic quality. Preiser et al. [69], on the other hand, evaluated it through the dimensions of technical, functional, and behavioral performance.

Beyond the traditionally defined functional and technical dimensions, the current literature emphasizes that space is not merely a matter of physical and geometric dimensions; it must be addressed in a more comprehensive and holistic manner, taking into account user experience and well-being, psychological and biological needs, and social connections [70–72]. The theoretical foundations of this multidimensional, comprehensive, and holistic approach are based on Alexander's [73] "pattern language" theory, which extends from the urban scale to building and interior space details. Alexander's [73] proposed pattern language argues that space and spatial design should be approached not as one-dimensional, independent, and isolated entities, but as a multidimensional, human (user)-centered, holistic, and interactive network. This user-centered approach is also supported by neuroarchitecture and environmental psychology research. Neuroarchitecture studies show that the physical characteristics of space directly affect human cognitive processes, emotions, perceptions, social interactions, and experiences [48,49,74–77]. In this context, it can be said that space (and therefore spatial quality) is closely related not only to physical, functional, and technical elements but also to perceptual, experiential, social, emotional, physiological, and psychological elements. Consequently, ensuring high spatial quality in student dormitories necessitates a holistic perspective that moves beyond basic physical metrics to prioritize these experiential and psychological dimensions, utilizing insights from neuroarchitecture as supporting mechanisms to enhance students' daily lives.

Spatial quality, which has a multidimensional structure and is influenced by various elements, has been highly important in many fields, especially design disciplines, both in the past and today [15,78]. For this reason, spatial quality must be carefully evaluated. The fact that each space has a distinct context and set of characteristics, together with the subjective and variable nature of users' perceptions of spatial quality, makes spatial quality difficult to measure and evaluate, as it is influenced by multiple factors [79,80]. For this reason, various tools are used to measure and evaluate spatial quality [69,81]. In architectural research, user satisfaction assessments are considered a fundamental tool for measuring and evaluating spatial quality, as they reflect users' perceptions of space [82–84].

This study also draws on user satisfaction assessments to measure the spatial quality of student dormitories. The term "spatial quality satisfaction" is used to describe students' overall satisfaction with the specific spatial attributes they perceive. This concept differs from general "user satisfaction" by focusing on the built environment rather than factors not directly related to spatial design, such as dormitory fees or management rules. Furthermore, it distinguishes itself from "perceived quality" by emphasizing the emotional fulfillment of the user rather than a purely cognitive evaluation of spatial features. While some frameworks include economic aspects of spatial quality [66], this study focuses on architectural variables that directly shape the user experience. By establishing this specific focus, the term targets variables that directly reflect the physical, functional, structural, environmental, aesthetic, perceptual, socio-cultural, psychological, and experiential dimensions of space [66–71,73]. By merging "spatial quality" and "user satisfaction," this approach aims to bridge the gap between the characteristics of a space and the experience of its users.

2.3. The Relationship Between Place Attachment and Spatial Quality Satisfaction

The formation and development of place attachment, which is quite important from both the human and spatial perspectives, is influenced by numerous factors, ranging from the physical, environmental, social, and cultural characteristics of the space to the individual's personality and socio-demographic characteristics and the duration of the individual's experience of the space [18,21,37]. The perceived quality of a space [85–89] and the feeling of 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 increases their place attachment. Khozaei et al. [29] conducted a survey with 267 students residing in dormitories at a state university in Malaysia to examine 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] conducted a survey with 751 students to examine the possibility that dormitory satisfaction mediates the relationship between fulfilled preferences and place attachment. Their study concluded 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. However, there are also studies [44,45] that suggest 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 research on 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 factors and criteria for spatial quality satisfaction (SQS) in student dormitories were first determined comprehensively. Accordingly, a systematic search was conducted in the Scopus and Web of Science (WoS) databases under the "Title, Abstract, Keyword" categories. The search included English-language publications, specifically articles, conference papers, books, and book chapters. These publications had to contain the following specific keywords: ("dormitor*" OR "student housing" OR "student accommodation*" OR "student residence*" OR "residence hall*" OR "hall* of residence" OR "student hostel*") AND (satisfaction* OR "space qualit*" OR

"spatial qualit*" OR "place qualit*" OR "quality of space*" OR "quality of place*" OR "design qualit*" OR "building qualit*" OR "environment* qualit*"). Then, the obtained publications went through a preliminary reading and were screened based on their relevance to the study scope, and 28 publications directly related to the study topic were selected. Next, each specific keyword group was searched individually on Google Scholar. For each search result, the most relevant studies were examined based on relevance ranking (e.g., the first five pages). As a result of this process, in addition to the 28 publications selected from Scopus and WoS, 12 new relevant publications were identified, reaching a total of 40 core studies.

When selecting the SQS factors and criteria from these 40 core studies, economic and administrative variables not directly related to spatial design, such as dormitory fees and management rules, were excluded. As the main selection criterion, only the architectural variables directly reflecting the physical, functional, structural, environmental, aesthetic, perceptual, socio-cultural, psychological, and experiential dimensions of "space" and "spatial quality" [66–70,73] were included.

Following this comprehensive search and selection process, 10 main factors defining spatial quality satisfaction in student dormitories and a total of 59 criteria under these factors were determined (Table 1; Appendix A). These 10 factors were named as follows: "Urban Location and Transportation (ULT)", "Spatial Organization and Accessibility (SOA)", "Comfort and Service Conditions (CSC)", "Safety and Structural Resilience (SSR)", "Facility Amenities (FA)", "Neighborhood 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)". Thus, by clarifying these factors and criteria derived from the literature, the answer to the preliminary research question (RQ1) of the study was obtained.

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

Factors	Criteria	Related Literature
Urban Location and Transportation (ULT)	ULT1-ULT3	[26,27,30,31,90–106]
Spatial Organization and Accessibility (SOA)	SOA1-SOA9	[26,27,31,32,65,91–97,99–121]
Comfort and Service Conditions (CSC)	CSC1-CSC9	[26,27,30–32,65,91–96,98–117,119–122]
Safety and Structural Resilience (SSR)	SSR1-SSR6	[26,27,30,31,65,90–97,99–101,104–107,112,114–117,119–122]
Facility Amenities (FA)	FA1-FA8	[26,27,30–32,65,90,93–107,109,110,112–122]
Nearby Environment Conditions and Facilities (NEC)	NEC1-NEC7	[26,27,65,96,97,99,101,103,104,107,109,115–117,119,121]
Flexibility of Use (FU)	FU1-FU3	[30–32,65,93,95,104,108–117,119]
Visual (Aesthetic) Quality (VQ)	VQ1-VQ3	[26,27,30–32,65,91–96,101,104,106,107,109,110,112–119]
Socio-cultural Interaction and Solidarity (SIS)	SIS1-SIS4	[27,30–32,93,96,98,99,101,103,107,108,110,112,115,116,121,123]
Emotional and Psychological Atmosphere (EPA)	EPA1-EPA7	[26,27,30–32,65,91–97,99,104,107–110,112–118,120–123]

Following the identification of the factors and criteria that constitute spatial quality satisfaction in student dormitories, two distinct theoretical models—one factor-based and the other holistic—were developed. This was done to better understand the multidimensional and multi-layered nature of human–space interaction [5,7–9,15], to more accurately reveal the effects of spatial quality satisfaction perception (both factor-based and holistic) on both overall satisfaction and place attachment, and to prevent the risk of potential over-specification. The development of these models was primarily based on:

- The research questions (RQ2-RQ9) and the theoretical framework;

- Studies obtained from the systematic literature review [26,27,30–32,65,90–123];
- Research showing that satisfaction with accommodation environments affects place attachment [29,30,38–40];
- Studies indicating that perceived spatial quality affects place attachment [85–89];
- Environmental psychology research showing that place satisfaction affects place attachment [38,40–43];
- A study emphasizing the significant mediating role of overall dormitory satisfaction in the relationship between fulfilled preferences and place attachment [30].

Model 1 (Factor-Based) examines the individual effects of the 10 factors comprising spatial quality satisfaction on overall dormitory satisfaction and place attachment, while accounting for their 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).

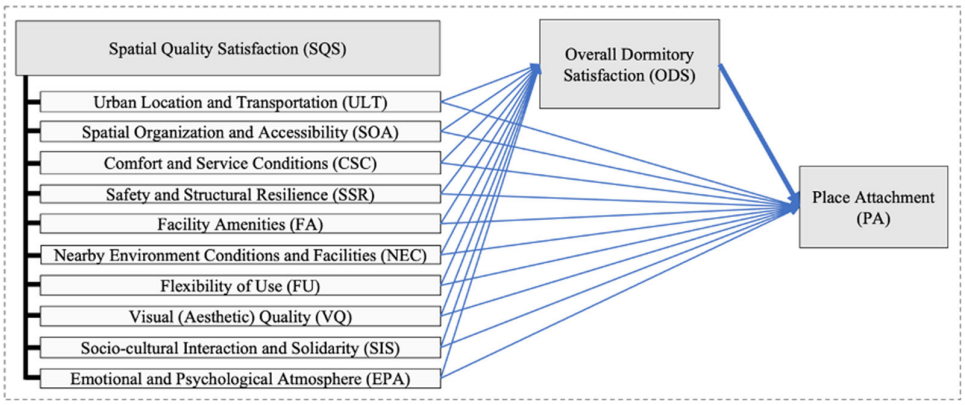

Figure 1. Theoretical model-1 (factor-based).

Model 2 (Holistic) evaluates the effect of spatial quality satisfaction in student dormitories as a whole on overall dormitory satisfaction and place attachment, and the mediating role of overall dormitory satisfaction in the effect of spatial quality satisfaction on place attachment (Figure 2).

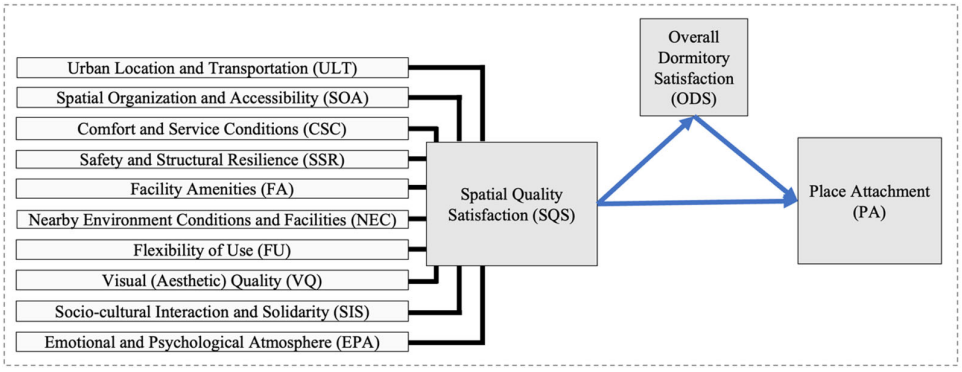

Figure 2. Theoretical model-2 (holistic).

3.2. Data Collection Tool Design

Questionnaires are one of the most common tools that enable systematic and practical data collection [124,125]. Through well-designed and properly prepared questionnaires, participants' evaluations can be collected through quality measurements, yielding accurate and reliable information [85,125]. In this regard, a draft survey form consisting of four main sections was designed as a data collection tool for the study, in line with the theoretical

models developed within the scope of the study, targeting students residing in state-run dormitories at the higher education level in the Central District of Kırklareli Province. First, the "Participant Information Section" was drafted, consisting of 12 questions in multiple-choice and open-ended formats, to collect information such as the participants' gender, age, department, class year, and dormitory in which they reside. Second, to measure participants' spatial quality satisfaction, the "Student Dormitory Spatial Quality Satisfaction Scale" was drafted. This scale consists of 59 items under 10 factors in a 5-point Likert format. It was developed based on the factors and criteria of spatial quality satisfaction in the student dormitories identified in the study, the literature research, and personal experience of living in state-run student dormitories at the higher education level for a long period (5 years). Third, to measure participants' place attachment, Lewicka's [37] "Place Attachment Scale," which has been proven to be both valid and reliable and consists of 12 items (including reverse-coded items) under a single factor, was adapted to the context of state-run student dormitories, resulting in the draft "Student Dormitory Place Attachment Scale". Fourth, to measure participants' overall dormitory satisfaction, the "Dormitory Satisfaction Scale," developed by Khozaei et al. [30], which has been proven to be both valid and reliable, consisting of 5 items under a single factor, was adapted to the context of state-run student dormitories, and the "Overall Dormitory Satisfaction Scale" in a 5-point Likert format was created as a draft.

After the draft questionnaire was created, the content validity and comprehensibility of the scales were assessed by consulting three experts and conducting a pilot study with 10 students residing in state-run student dormitories at the higher education level. The first expert is an Assistant Professor with over 20 years of experience in building science and interior design, whose work also covers user perception. The second expert is an Associate Professor with over 10 years of experience in urban planning, including studies on the built environment and user satisfaction. The third expert is an Assistant Professor with over 15 years of experience in applied statistics and structural equation modeling (SEM), with expertise in survey data analysis. As a result of the review, several revisions were made to the draft survey form: (1) the items in the scales in the draft survey form were made more understandable for participants, and (2) the locations of sections in the draft survey form were changed to most effectively capture the attention of participants throughout the survey. Consequently, the final survey form was established (Appendix B).

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 (EFF) Student Dormitory (Figure 3a), Hundi Hatun Female (HHF) Student Dormitory (Figure 3b), Ahmet Cevdet Pasha Male (ACM) Student Dormitory (Figure 3c), Şemseddin Sami Male (SSM) Student Dormitory (Figure 3d), and Kırklareli Male (KLM) Student Dormitory (Figure 3e) [126].

EFF Student Dormitory (built in 2017) is located 9.3 km from the city center, with the Kayalı Campus, HHF Student Dormitory, and rural areas in its close surroundings. Within the dormitory complex, there are three 5-floor L-shaped accommodation buildings and a rectangular dining-social building. The room units include an entrance hall, a wet area, a study space, and sleeping areas.

HHF Student Dormitory (built in 2016) is located 9.4 km from the city center, sharing its immediate surroundings with the Kayalı Campus, EFF Student Dormitory, and rural areas. The dormitory complex consists of three 5-floor L-shaped accommodation buildings and one L-shaped dining-social building. Inside the room units, there is an entrance hall, a wet area, a study space, and sleeping areas.

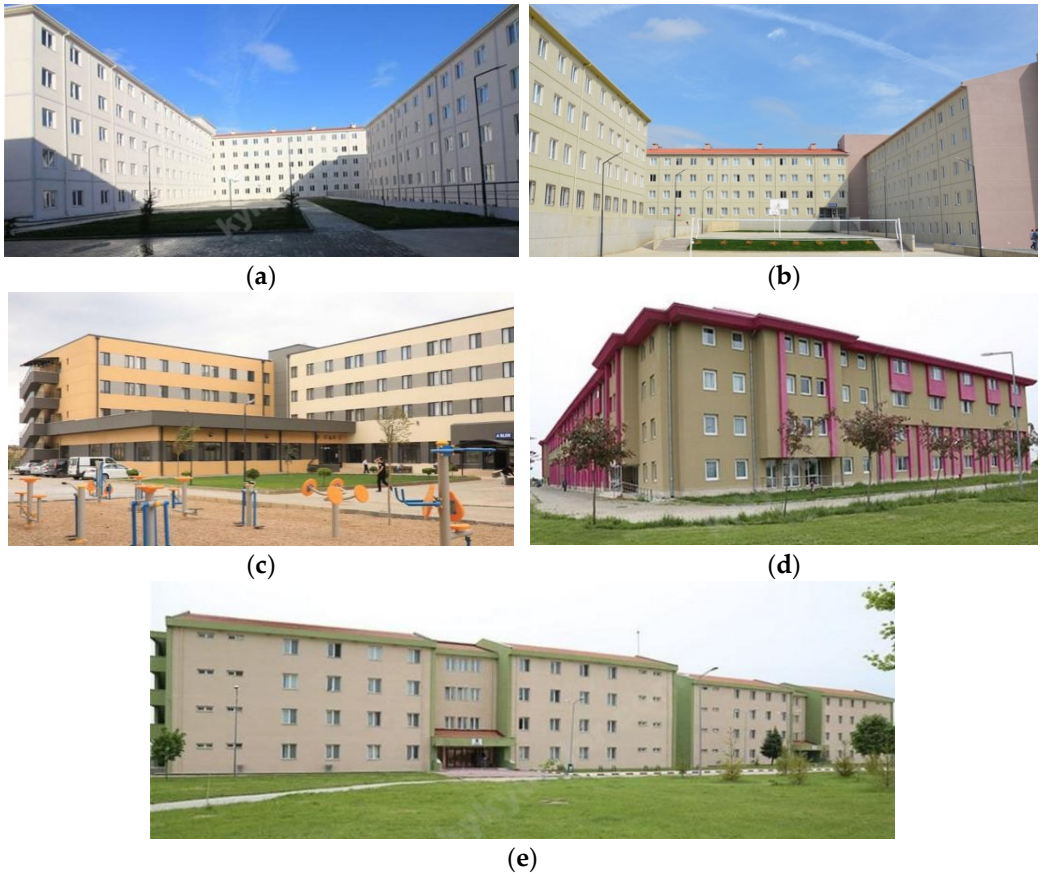

Figure 3. State-run student dormitories in the Central District of Kırklareli Province: (**a**) EFF Student Dormitory; (**b**) HHF Student Dormitory; (**c**) ACM Student Dormitory; (**d**) SSM Student Dormitory; (**e**) KLM Student Dormitory [126].

ACM Student Dormitory (built in 2017) is located 7.0 km from the city center and is surrounded entirely by rural areas. The dormitory complex comprises two 4-floor accommodation buildings in E and rectangular forms, with the dining and social areas situated inside the E-formed building. The room units feature an entrance hall, a wet area, a study space, and sleeping areas.

SSM Student Dormitory (built in 2010) is located 4.0 km from the city center, with the Karahıdır Campus and KLM Student Dormitory in its close surroundings. Within the dormitory complex, there is a 4-floor U-shaped accommodation building and a rectangular dining-social building. The room units contain only a wet area and sleeping areas.

KLM Student Dormitory (built in 2002) is located 3.3 km from the city center, with the Karahıdır Campus, SSM Student Dormitory, and residential areas in its close surroundings. The dormitory complex includes two 4-floor T-shaped accommodation buildings and a rectangular dining-social building. The room units consist solely of sleeping areas, while the wet areas and study spaces are located in the floor corridors.

To calculate the sample size, the total capacities of the dormitories were first determined. As shown in Table 2, the total capacity of the dormitories was calculated as "6954 students" [127].

After determining the total capacity of the dormitories, the minimum sample size was calculated as "364 participants" using the "table of acceptable sample sizes for specific populations" specified by Sekaran [128] for quantitative research. However, to improve the quality of the measurements, it was decided that the study would ultimately be conducted with "450 participants.". To determine how many participants to include from each dormitory, stratified sampling was used among the probability sampling methods, as it

was more suitable for the study's design. The proportional distribution of the participants according to the dormitories they resided in was as follows: 146 participants from EFF Student Dormitory, 129 participants from the HHF Student Dormitory, 97 participants from the ACM Student Dormitory, 40 participants from the SSM Student Dormitory, and 38 participants from the KLM Student Dormitory (Table 3).

Table 2. Capacities of state-run student dormitories in the Central District of Kırklareli Province [127].

Dormitory Name	Capacity (Student)
Evlad-ı Fatihan Female (EFF) Student Dormitory	2250
Hundi Hatun Female (HHF) Student Dormitory	2000
Ahmet Cevdet Pasha Male (ACM) Dormitory	1500
Şemseddin Sami Male (SSM) Student Dormitory	624
Kırklareli Male (KLM) Student Dormitory	580
Total	6954

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

Dormitory Name	Capacity (Student)	Proportional Distribution
EFF Student Dormitory	2250	146
HHF Student Dormitory	2000	129
ACM Student Dormitory	1500	97
SSM Student Dormitory	624	40
KLM Student Dormitory	580	38
Total	6954	450

3.4. Data Collection Method and Process

Research data were collected through face-to-face surveys using a questionnaire. Before collecting the research data, the necessary ethical committee permission was first obtained from the Yıldız Technical University Social and Human Sciences Research Ethics Committee on 30 June 2025, with report number "20250605681" and verification code "34634". Subsequently, verbal permission was obtained from the Kırklareli Provincial Directorate of the Ministry of Youth and Sports (GSB) to facilitate entry into the dormitories. Following these permissions, each of the five dormitories was visited individually. Participants were recruited by visiting dining halls, study halls, and individual student rooms within each dormitory, where students were invited to participate through face-to-face communication. To ensure reliable spatial experience data, an inclusion criterion was applied: only students who had resided in their respective dormitory for at least one semester were invited to participate. Participation was entirely voluntary, and after providing consent, a survey lasting 10–15 min was conducted with each participant, in accordance with the predefined sample size for each dormitory.

After the survey was conducted, all completed forms were checked. For each dormitory, if any were found to be incomplete (i.e., items being left blank in the scales) or incorrect (i.e., selecting the same option for all questions despite the presence of reverse-coded items in the place attachment scale), the researchers re-entered the relevant dormitories and conducted face-to-face surveys with new participants equal to the number of incomplete/incorrect forms. Subsequently, the newly completed forms were checked, and all were found to be valid. Subsequently, 450 properly completed survey forms were entered into Microsoft (MS) Excel, and the data entry was checked for accuracy. Any incorrectly entered data was corrected and re-entered. Finally, the newly entered data was also checked

and confirmed to be correct. Thus, a "digitized data set" was obtained. The identifying information of the 450 participants in the survey study is shown in Appendix C.

3.5. Validity and Reliability Analyses

The two fundamental criteria for evaluating measurement quality in survey research are reliability and validity. Reliability refers to the extent to which a measurement instrument yields consistent results under the same conditions and indicates the degree to which the obtained results are free from measurement error. Validity, on the other hand, concerns the extent to which an instrument accurately and appropriately measures the construct it is intended to measure without confusing it with other characteristics. Since a reliable scale does not necessarily produce valid measurements, reliability alone is insufficient in scale development and adaptation studies. Therefore, both the reliability and validity of scales must be established [129,130].

In scale development or adaptation processes, factor analysis methods are used to prove construct validity. Factor analysis is applied using two methods: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). EFA is used in the initial phase of scale development or adaptation studies to determine how the variables defining the structure to be measured group under specific factors [131,132]. CFA is used to test the validity of structures derived from EFA, to analyze the relationships between a structure and the items that constitute it, and to evaluate the suitability of the data to the predefined conceptual model [133]. The reliability of scales is evaluated using the internal consistency method. Cronbach's Alpha [134] is an appropriate measure of reliability for Likert-type scales. In this study, EFA and CFA were performed with SPSS (Statistical Package for Social Sciences) 25.0 and AMOS (Analysis of Moment Structures) 23.0 to test the construct validity of all scales. Cronbach's Alpha was used to test reliability.

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

Before performing Exploratory Factor Analysis (EFA) on the Spatial Quality Satisfaction Scale, the Kaiser–Meyer–Olkin (KMO) Test was conducted to assess the suitability of the sample size for factor analysis. The analysis revealed a KMO value of 0.941 (Table 4). This value indicates that the sample size is quite adequate for factor analysis [135,136]. Furthermore, when the Bartlett's Test of Sphericity results were examined, it was found that the obtained chi-square value ($\chi^2(1540) = 18{,}982.879$; $p < 0.001$) was statistically significant, and that the correlation matrix was suitable for factor analysis (Table 4) [125,137,138].

After confirming the scale's suitability for factor analysis, an EFA was performed. As a result of the analysis, considering the lower threshold value of 0.40 recommended in the literature for factor loadings [125,135,139], three cross-loading items (FA1, FA8, and EPA1) were removed from the scale despite having factor loadings above the threshold value, as they showed high loadings under more than one factor. During the factor analysis, it is recommended that cross-loadings be removed from the scale to ensure construct validity and factor distinctiveness [124,125,135]. After removing the relevant items, the remaining 56 items clustered into the theoretically predicted 10 factors, with all items loading adequately only under their respective factors, showing no significant cross-loadings, and representing the relevant factors well (Table 4). Moreover, the total variance explained by the obtained factor structure was calculated as 68.324% (Table 4). In multi-factor scales, a total variance explained of 50% or above indicates that the factor structure is adequate and the measured structure can be explained [124,135,140]. The scale's reliability was evaluated using Cronbach's alpha. The analysis revealed a Cronbach's Alpha coefficient of 0.961 (Table 4). This value indicates that the scale has a very high level of internal consistency [124,141,142]. Although such a high Cronbach's alpha

value can sometimes suggest redundancy among items [140], it is considered acceptable in this study given the scale's comprehensive structure, which comprises 56 items across 10 distinct dimensions. In multi-item scales, Cronbach's alpha is mathematically prone to increase as the number of items grows [141]. Furthermore, the distinct factor loadings and high explained variance (68.324%) confirm that the items capture a broad range of spatial quality satisfaction attributes rather than mere repetition [135].

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								
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				

Table 4. *Cont.*

Items	Factors									
	F1 (ULT)	**F2 (SOA)**	**F3 (CSC)**	**F4 (SSR)**	**F5 (FA)**	**F6 (NEC)**	**F7 (FU)**	**F8 (VQ)**	**F9 (SIS)**	**F10 (EPA)**
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									
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; $\chi^2(1540)$ = 18,982.879; Bartlett's Test of Sphericity (p) < 0.001										

Following EFA and reliability analysis, Confirmatory Factor Analysis (CFA) was conducted. Model fit was initially assessed by examining the CMIN/DF, RMSEA, CFI, TLI, IFI, RFI, NFI, and SRMR indices [132,135,139,143,144]. The initial results indicated a need for improvement. Based on the modification indices, the items causing model misfit were identified, and improvements were made by defining covariance paths between the error terms of items showing high residual covariance. As a result, the re-estimated model fit the data well (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) shows that all scale items have statistically significant factor loadings (p < 0.001) above the acceptable 0.40 threshold [125,135,139]. The t-values for all items also exceed the critical value of 1.96. These results confirm that items robustly represent their factors and indicate convergent validity in the measurement model [145]. Thus, the CFA results support the scale's construct validity.

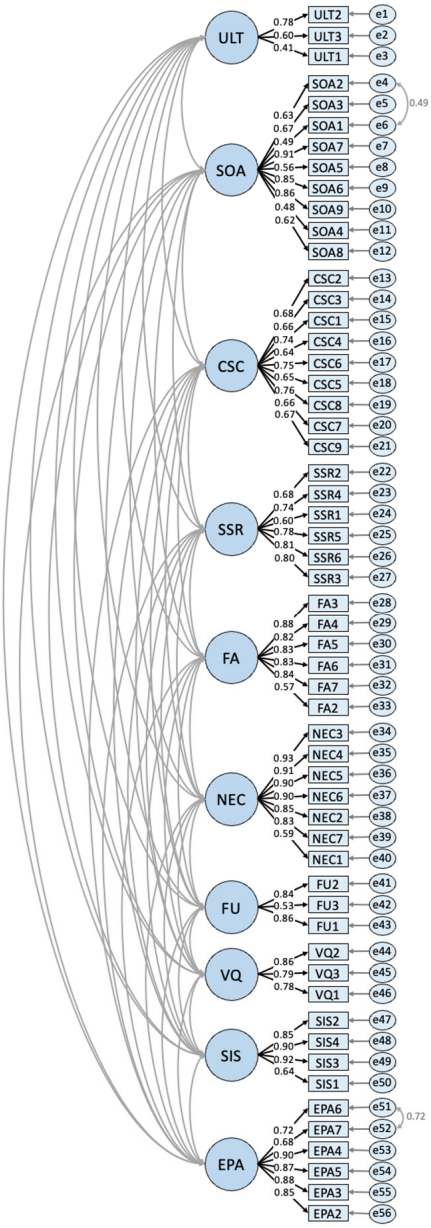

Figure 4. First-order multiple factor CFA model of the spatial quality satisfaction scale.

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	***
	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	***

Table 6. *Cont.*

Factors	Items	Factor Loadings	Standard Errors	t Values	*p* Values
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	***

*** $p < 0.001$.

3.5.2. Validity and Reliability Analyses of the Place Attachment Scale

The suitability of the sample for the Place Attachment Scale was confirmed by a KMO value of 0.860 (Table 7), indicating a sufficiently large sample size [135,136]. Additionally, Bartlett's Test of Sphericity yielded statistically significant results ($\chi^2(45) = 1583.345$,

$p < 0.001$), confirming the suitability of the correlation matrix for factorization (Table 7) [125,137,138].

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; $\chi^2(45) = 1583.345$; Bartlett's Test of Sphericity (p) < 0.001	

During the EFA process, two items falling below the recommended loading threshold of 0.40 (PA1 = 0.204 and PA8 = 0.058) [125,135,139] were removed from the scale to ensure structural clarity [124,125,135,138]. The remaining 10 items clustered into a single factor, as theoretically predicted (Table 7). This single-factor structure accounted for 43.864% of the total variance (Table 7). While this explained variance is relatively low, it exceeds the 40% threshold often cited as a minimum acceptable level for unidimensional scales in social science research [124,135,140]. This result implies that place attachment is an inherently complex and multifaceted construct, influenced by various individual and contextual factors that may not be fully captured within a single-factor model. Nevertheless, considering the high Cronbach's Alpha of 0.839 (Table 7) and adequate factor loadings, the scale is deemed to have sufficient construct validity and internal consistency to represent the intended theoretical framework [124,141,142].

Subsequently, CFA was conducted using standard fit indices [132,135,139,143,144]. 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 attachment 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 the literature, which suggests that loadings above 0.30 are acceptable

for large sample sizes [124,135,139,146], and by the item's theoretical significance to the construct of place attachment. Moreover, all t-values exceeded the critical threshold of 1.96. Consequently, the CFA results confirm the construct validity and suitability of the scale [145].

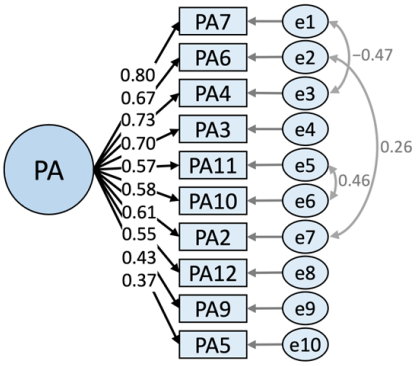

Figure 5. Single-factor CFA model of the place attachment scale.

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 Overall Dormitory Satisfaction Scale, the KMO value was 0.837 (Table 10), indicating adequate sample adequacy [135,136]. 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) [125,137,138].

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; $\chi^2(10) = 1448.301$; Bartlett's Test of Sphericity (p) < 0.001	

The EFA results revealed that all items loaded onto a single factor with loadings exceeding the 0.40 threshold [125,135,139] and that there were no significant cross-loadings (Table 10). Notably, the total variance explained by this factor structure is 71.535% (Table 10).

Considering that a variance explained of 40% or higher is considered sufficient for single-factor scales [124,135,140], this result confirms the robustness of the structure. In the reliability analysis, a Cronbach's Alpha value of 0.899 was obtained, indicating high internal consistency (Table 10) [124,141,142].

Finally, CFA was performed to test the measurement model using established fit indices [132,135,139,143,144]. Modifications were applied to the measurement model to enhance fit. The re-estimated 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 [125,135,139]. 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 [145]. Consequently, the CFA results confirm the unidimensional factor structure and construct validity of the scale.

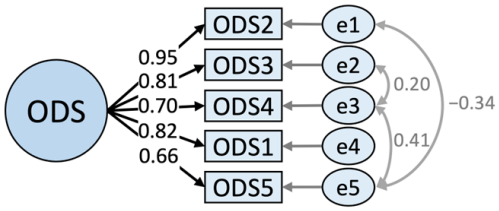

Figure 6. Single-factor CFA model of the overall dormitory satisfaction scale.

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 answer the research questions identified in the study (RQ2-RQ9) and test the proposed theoretical models (Model 1 and Model 2), the data were analyzed using AMOS 23.0.

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, allowing for the simultaneous analysis of complex causal relationships between observed and latent variables [125]. SEM

is applied to test the theoretical adequacy of multiple relationships, i.e., the connections between factors, in a complex/comprehensive structural model [147]. This method allows researchers to test theoretical assumptions, interpret complex structures among variables, better understand the interactions (direct and indirect) among variables in the model, and test and compare alternative models [135,145]. Furthermore, unlike traditional multivariate analysis methods, SEM explicitly accounts for measurement errors, thereby yielding more accurate and reliable estimates [148].

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 [132,135,139,143,144], 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, criteria for hypothesis acceptance are evaluated based on both the *p*-value and β (standardized path coefficient). The *p*-value indicates whether the hypothesis is significant ($p \geq 0.05$ = not significant; $p < 0.05$ = significant; $p < 0.01$ = highly significant; $p < 0.001$ = very highly significant), while the β value indicates the magnitude of the effect (β < 0.10 = very weak effect/no effect; β ≥ 0.10 = weak effect; β ≥ 0.30 = moderate effect; β ≥ 0.50 = strong effect) and direction (+ = positive; − = negative) [135,139]. For mediation hypotheses, the Bootstrap confidence interval is used rather than the *p*-value. "The absence of zero (0) in the 95% Confidence Interval values" indicates that the mediating role is statistically significant [149,150].

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) (β = 0.168, $p < 0.01$);
- Emotional and Psychological Atmosphere (EPA) exerts a statistically significant, positive, and moderate effect on ODS (ODS) (β = 0.469, $p < 0.001$);
- Overall Dormitory Satisfaction (ODS) has a statistically significant, positive, and strong effect on Place Attachment (PA) (β = 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).

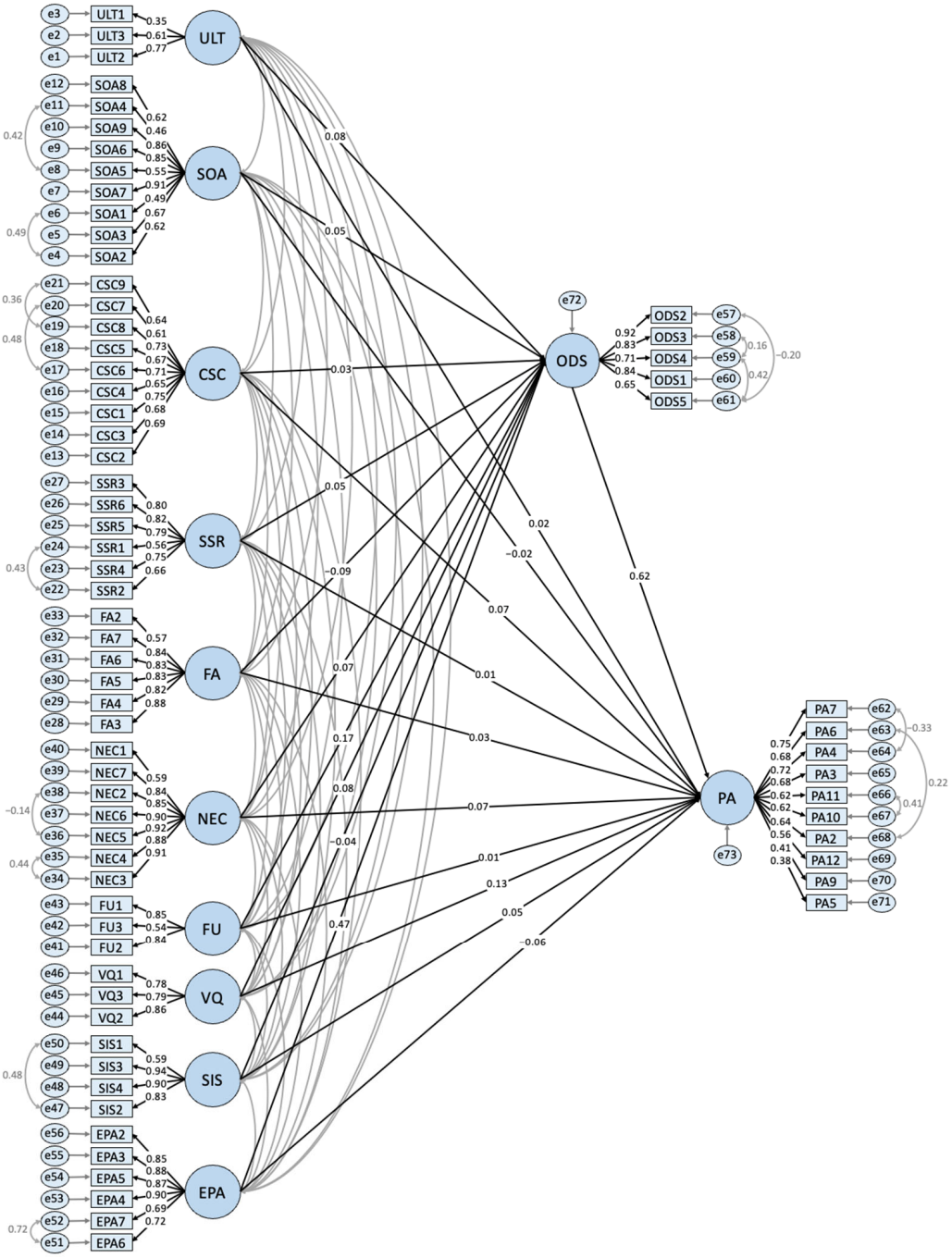

Figure 7. Research model-1.

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

Table 14. *Cont.*

Hypothesis	β	Standard Errors	*t*	*p*	Results
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

** $p < 0.01$; *** $p < 0.001$; the arrow symbol (➔) indicates the structural path between the variables.

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).

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 [132,135,139,143,144], 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
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) (β = 0.654, $p < 0.001$).
- SQS exerts a statistically significant, positive, and moderate effect on Place Attachment (PA) (β = 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

*** $p < 0.001$; the arrow symbol (➔) indicates the structural path between the variables.

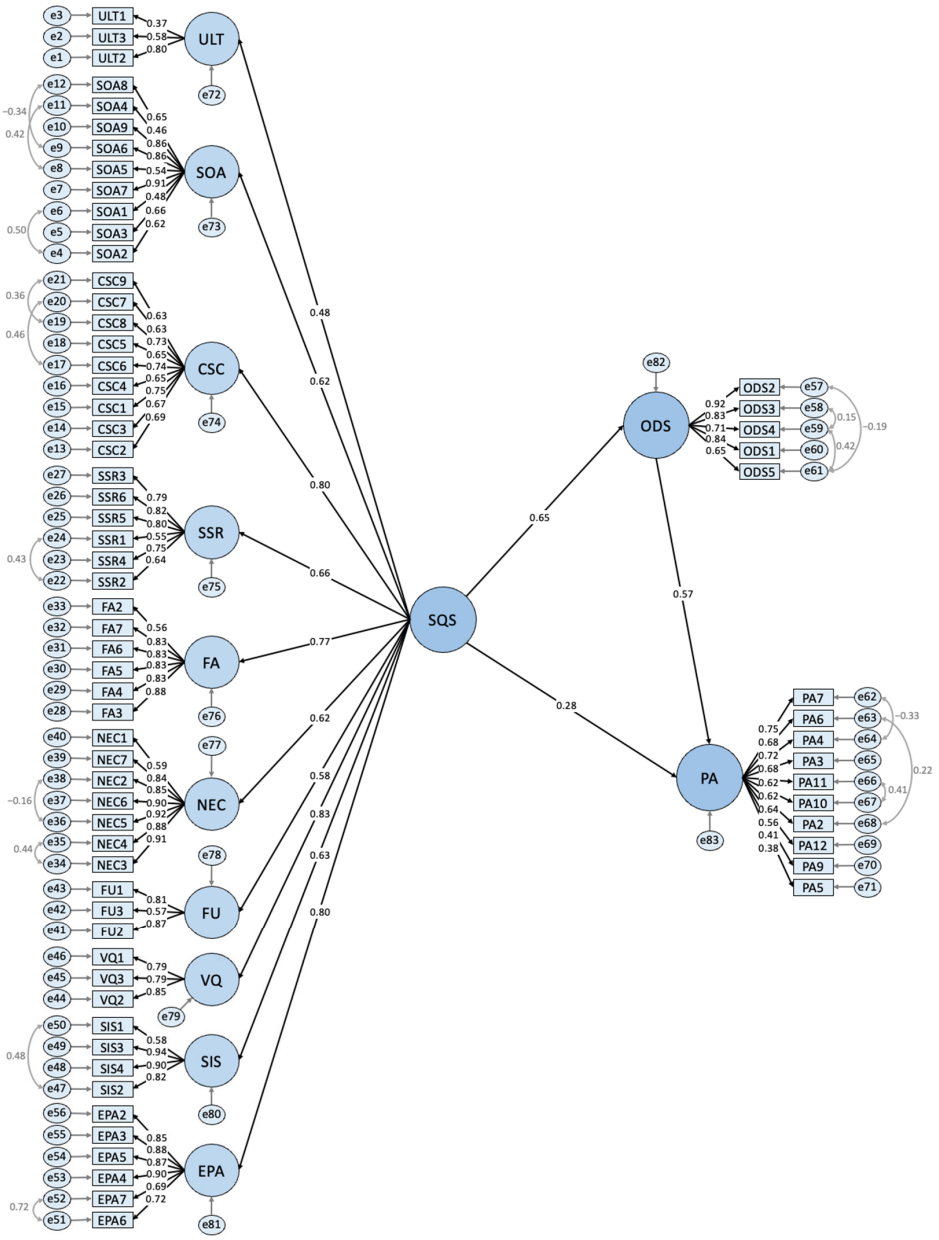

Figure 8. Research model-2.

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).

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

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

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).

5. Discussion

5.1. Individual Effects of SQS Factors

In Model 1, which was 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 different components: Urban Location and Transport (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). Within this framework, Model 1 examined the individual effects of these 10 factors—taking into account their relationships—on Overall Dormitory Satisfaction (ODS) and Place

Attachment (PA). Additionally, Model 1 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 10 factors comprising the SQS have a statistically significant direct effect on PA when considered individually. Furthermore, eight of these factors (ULT, SOA, CSC, SSR, FA, NEC, VQ, and SIS) do not have a statistically significant direct effect on ODS when considered individually. In contrast, Emotional and Psychological Atmosphere (EPA) and Flexibility of Use (FU) emerge as factors that have a direct effect on ODS and an indirect effect on PA through ODS. This implies that most of the SQS factors in student dormitories are insufficient on their own to produce meaningful changes in overall dormitory satisfaction or place attachment. On the other hand, the EPA and FU factors are the most decisive at the individual level. These findings indicate that when making factor-specific improvements in dormitory spaces, priority should be given to developing the emotional–psychological atmosphere and flexibility of use.

Within the scope of the EPA factor, dormitory spaces must be designed in a way that positively affects users' general moods and quality of life, enabling them to feel intimate, peaceful, free, and happy in these spaces. In this regard, in order to positively influence their general mood and quality of life, dormitory spaces can be designed in accordance with design and livability principles for everyone, furnishings (sofas, carpets, etc.) can be included to make users feel at home, ergonomic and durable furniture can be preferred, green areas can be designed within the dormitory complex, and various spatial opportunities and facilities can be provided for social, cultural and sporting activities. Furthermore, as emphasized in the neuroarchitecture and biophilic design literature, natural lighting optimizations that support the circadian rhythm and color palettes inspired by nature can be used to reduce users' physiological stress levels and negative psychological states such as anxiety and depression [48,49]. To contribute to a sense of intimacy, spaces can be designed to be human-scale, with warm colors and organic/natural materials (wood, stone, etc.) preferred for the surfaces of spaces and furnishings [75]. Large-volume common areas can be divided into sub-areas with plant separators and lighting elements to create semi-private niches, and window seats/niches can be provided in rooms so that students can look outside. To ensure a sense of peace, natural-textured materials that provide visual tranquility can be used on surfaces instead of synthetic/glossy materials, and acoustic control measures (acoustic comfort-providing layout strategies, sound insulation materials, etc.) can be implemented to reduce noise [74]. To help them feel free, spaces can be designed to be spacious, well-ventilated, and make maximum use of natural light, and flexible, modular fixtures suitable for personal use/rearrangement can be used in the spaces. To help them feel happy, instead of standardized/uniform spatial configurations, alternative spatial configurations and facility options that offer a high degree of spatial diversity and can respond to the various desires and needs of different user profiles can be incorporated. Finally, it should not be forgotten that all these elements must be addressed within a holistic design approach to most effectively ensure satisfaction with the EPA factor.

Within the scope of the FU factor, dormitory spaces and the comfort conditions within these spaces (heating, cooling, ventilation, lighting, acoustics) must be designed to allow users flexibility in personalization/modification, and dormitory rooms must offer functional diversity/flexibility. In this regard, in order to increase the flexibility for personalization and modification in dormitory spaces, basic furnishing elements (bed, table, wardrobe, desk, etc.) can be designed as modular, movable, and convertible units that allow the user to create their own spatial layout, rather than fixed systems. To give users control over comfort conditions, spaces can incorporate climate control panels/interfaces that users can adjust, step-by-step/local lighting systems that adapt to the user's needs,

and flexible window systems that support natural ventilation. To support the functional diversity/flexibility of dormitory rooms, rigid spatial designs that restrict the space solely to sleeping functions can be avoided, and multi-purpose (hybrid) living spaces can be designed using movable panels, acoustic separators or convertible furniture to enable rooms to serve different activities such as studying, resting, socializing, and eating, either simultaneously or at different times of the day. Finally, to maximize satisfaction with the FU factor, it would be beneficial to adopt a dynamic architectural design approach that offers users the opportunity to control and rearrange the space according to their needs. At this point, to take the concept of flexibility to a digital and innovative dimension, current technologies such as artificial intelligence (AI), eye tracking, biometric analysis, and virtual reality (VR) [75,151–153], can be integrated into architectural design processes to create smart, responsive, interactive, and flexible spaces that adapt to users' sensory and physiological needs in real time.

Nevertheless, the findings of Model 1 also indicate that ODS has a statistically significant, positive, and strong effect on PA. This finding corroborates previous studies reporting that satisfaction with accommodation facilities, such as student dormitories, student houses, hostels, and residences, positively and significantly contributes to individuals' place attachment [29,30,38–40].

5.2. Holistic Perception of SQS

In Model 2 (holistic model), another model proposed and tested in this study, the 10 factors constituting Spatial Quality Satisfaction (SQS) in student dormitories are not evaluated separately but are combined into a holistic "Spatial Quality Satisfaction (SQS)" construct. Within this framework, Model 2 assesses the direct effects of holistic SQS on ODS and PA and the mediating role of ODS in the effect of SQS on PA. Furthermore, Model 2 assesses the extent to which the 10 factors comprising SQS reflect a holistic perception of SQS.

The findings from Model 2 indicate that 9 of 10 factors (SOA, CSC, SSR, FA, NEC, FU, VQ, SIS, and EPA) generally represent a strong or very strong level of SQS perception. In contrast, the Urban Location and Transportation (ULT) represents a weak-to-moderate level. This situation demonstrates that the multidimensional SQS structure developed within the scope of the study is both robust and reliable, while also showing that the contribution of the ULT dimension to shaping users' overall perception of spatial quality satisfaction in student dormitories is relatively limited.

Additionally, Model 2 revealed that SQS as a whole directly and positively influenced ODS and PA, and that ODS's mediating role in SQS's overall effect on PA was quite significant and meaningful. These findings support the following studies: (i) studies showing that perceived place quality significantly affects place attachment [85–89]; (ii) studies stating that, in connection with environmental psychology, place satisfaction significantly and positively affects place attachment [38,40–43]; (iii) studies indicating 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 [30].

5.3. Dual-Model Comparison: Theoretical Advancement

As a key point, a noteworthy result emerges when comparing the findings of Model 1 and Model 2, which offers a clear and generalizable theoretical advancement for environmental psychology and architectural literature. While the factors constituting the SQS cannot individually exert a decisive influence on ODS and PA (Model 1), the holistic SQS perception formed by these components in the user's mind is a fundamental

predictor of both ODS and PA (Model 2). Theoretically, this dual-model framework moves beyond the traditional "satisfaction–attachment" perspective by proving that individual dimensions of space and spatial quality are insufficient to generate emotional bonds. In other words, it has been demonstrated that in the human brain and emotional perception, SQS components are evaluated not separately but collectively and as a unified feeling. Indeed, recent studies in the fields of neuroarchitecture and environmental psychology also support the notion that the human brain processes environmental stimuli not through independent mechanisms, but through integrated systems in which cognitive, emotional, and sensory processes are interconnected [48,49,75,76]. These findings indicate that SQS is not an atomistic process but a holistic experience, and they coincide with the principle that "the whole is greater than the sum of its parts" in both the "Gestalt Theory" of perception psychology and the concept of "Synergy Effect" in systems theory [154–156]. The theoretical implication obtained possesses universal significance, as it proves that human beings perceive space holistically and that place attachment can only be formed through this spatial synergy. Similarly, the findings are consistent with Alexander's [73] "pattern language" theory, which argues that space and spatial design should be approached as a holistic and interactive network [72,73]. This situation indicates that, rather than focusing on just one dimension of SQS in student dormitories, improvements should be made within a holistic SQS framework, where all components work in harmony. To implement this synergistic and holistic approach in architectural design practice, it is recommended that all dimensions and criteria addressed in the study be considered as an integrated system that balances each other. This is because a deficiency in one dimension of spatial quality can overshadow or hinder the success of other dimensions. For example, a dormitory space with high Visual (Aesthetic) Quality (VQ) but inadequate Comfort and Service Conditions (CSC) will not create holistic satisfaction in the minds of users. Therefore, architects, designers, and facility managers must consider all parameters that constitute SQS not as independent checklists but as an interactive and multi-layered "spatial quality network" that enhances each other's value.

Finally, findings from both models show that ODS is a significant mediator between SQS and PA. This validates the role of ODS in theoretical models and highlights its importance in showing how perceptions of spatial quality lead to stronger emotional ties to place.

6. Conclusions

6.1. Summary of Key Findings

The findings of this study reveal that most of the factors constituting Spatial Quality Satisfaction (SQS) in student dormitories do not significantly affect 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 primary determinants, as they directly affect ODS and indirectly affect PA through ODS.

The results also reveal that ODS has a statistically significant, strong, and positive effect on PA, highlighting its critical role in developing students' emotional bonds with their dormitory environments.

Unlike the factor-based approach, the findings reveal that, when considered holistically, SQS has a strong, direct, and meaningful impact on both ODS and PA. Furthermore, ODS plays a highly significant mediating role in the relationship between holistic SQS and PA.

Taken collectively, these findings suggest that improvements aimed at increasing overall dormitory satisfaction and place attachment in student dormitories can be achieved

more effectively through a holistic spatial quality approach rather than interventions focused on isolated or fragmented spatial factors.

6.2. Original Value/Contribution

This study has original value and makes significant contributions in three main dimensions: theoretical, methodological, and practical. From a theoretical perspective, the originality of the study lies in its pioneering examination of Spatial Quality Satisfaction, Overall Dormitory Satisfaction, and Place Attachment within a single, integrated theoretical framework in the context of state-run student dormitories at the higher education level. By testing the direct and indirect relationships among these variables through both factor-based and holistic approaches, the study addresses and fills an important theoretical gap in the literature, where these concepts have rarely been examined together in a systematic and comprehensive manner. Furthermore, unlike limited studies in the literature that focus only on specific dimensions, one of the primary theoretical contributions of this study is its highly detailed examination of spatial quality satisfaction in student dormitories under 10 factors and 59 criteria. This approach encompasses all components of space and spatial quality (physical, functional, structural, environmental, aesthetic, perceptual, socio-cultural, psychological, and experiential). This holistic framework integrates a broad spectrum into a single model, ranging from urban location and transportation to spatial organization and accessibility, from comfort and service conditions to safety and structural resilience, from facility amenities to surrounding environmental conditions and facilities, from flexibility of use to visual (aesthetic) quality, and from socio-cultural interaction and solidarity to the emotional and psychological atmosphere. Moreover, the study strengthens its theoretical contribution by clearly identifying the components constituting SQS and empirically revealing the extent to which each component represents the holistic perception of SQS.

From a methodological perspective, the originality of the study stems from its comprehensive, multi-stage, and systematic research design, encompassing the entire research process from literature review and theoretical model development to scale development/adaptation and advanced multivariate analyses using Structural Equation Modeling (SEM). Within this framework, the Spatial Quality Satisfaction Scale, developed specifically for the context of student dormitories, and the adapted Overall Dormitory Satisfaction Scale and Place Attachment Scale were rigorously validated through expert evaluation, pilot testing, exploratory and confirmatory factor analyses, and reliability analyses, thereby providing robust measurement instruments for SEM applications. In addition, 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 both factor-based and holistic theoretical models further enhances the methodological rigor and originality of the study.

From a practical perspective, the study contributes original models, validated scales, and conceptual explanations to the fields of spatial quality satisfaction, place attachment, student dormitory satisfaction, and human–space interaction. By rendering SQS, ODS, and PA measurable in student dormitories, the study provides a strategic data source for decision-makers, designers, and administrators. Furthermore, by statistically demonstrating both the individual and holistic effects of spatial quality dimensions on place attachment—along with the mediating role of overall dormitory satisfaction—the study offers an applicable and evidence-based roadmap to guide dormitory management policies, architectural design processes, and interventions aimed at improving student well-being. Moreover, the broader impact of these practical contributions is further amplified by the scale of the working context. The Ministry of Youth and Sports (GSB) is the largest provider

of student accommodation in the country. According to 2025 data, the GSB operates 868 state-run student dormitories with a total capacity of 996,306 students at the higher education level across Turkey [28]. Therefore, the findings, models, and recommendations presented in this study have the potential to directly or indirectly influence policies concerning spatial quality, student dormitory satisfaction, and place attachment within the nationwide student accommodation network.

6.3. Limitations and Future Research

The study was designed based on specific variables and a limited sample of 450 participants residing in state-run student dormitories at the higher education level in the central district of Kırklareli, Turkey. Since the sample size was not sufficient to divide the data set into two, exploratory and confirmatory factor analyses were conducted on the same sample. This situation is considered a methodological limitation in terms of the generalization of the findings. In this context, the findings should be interpreted within the current study's framework. To strengthen the structural validity and generalization of the models proposed in the study, future research should include cross-validation tests with larger sample groups. Additionally, in the study, despite the methodological precautions taken to maintain participants' attention (e.g., Likert-type format, categorization under 10 factors, and pilot study validation), the 59-item structure of the SQS scale is relatively long. Therefore, potential respondent fatigue, which is commonly observed in scale development studies, is acknowledged as a limitation. Future studies should pay greater attention to this issue in similar scale development processes.

Another limitation of the study is the way in which the concept of place attachment is addressed. In measuring place attachment, there is still no consensus in the literature on whether the concept should be approached as one-dimensional or multidimensional. For example, Lewicka [37] treats this concept as a single-factor structure; Williams and Vaske [55] treat it in two factors, namely place identity and place dependence; while Chen et al. [40] treat it in four factors, namely place identity, place dependence, emotional attachment, and social bond. In this study, considering the comprehensive structure of the independent variable, SQS, consisting of 10 factors, and the mediating role of ODS in the model, PA was treated as a single-factor structure to maintain the simplicity of the model. This choice was also statistically confirmed by the EFA, CFA, and reliability analyses conducted in this study. We recommend that future studies conceptualize place attachment as a multidimensional structure to reveal the unique effects of the components of spatial quality satisfaction on different sub-factors of place attachment (place identity, place dependence, etc.) and to provide a more in-depth perspective to the literature.

Although this study provides a strong framework, its findings are specific to the context of state-run dormitories in Turkey. The definitions and relative importance of Spatial Quality Satisfaction factors are subjective and may vary depending on different socio-cultural backgrounds, institutional policies, and dormitory types (e.g., state-run versus private dormitories). Therefore, the structural relationships identified in this case study cannot be directly generalized globally without further cross-cultural validation. For this reason, it is important to test the proposed models in student dormitories with different characteristics in different geographical regions and cultural contexts in order to compare the results. Furthermore, testing the scales developed and adapted in this research 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 generalization of the model.

Finally, this study uses quantitative research methods. In future studies, supporting quantitative data with qualitative methods such as focus group studies and in-depth inter-

views (mixed methods) will allow for a more comprehensive and detailed understanding of users' perceptions of SQS, ODS, and PA, beyond numerical data. Furthermore, integrating emerging technologies like AI, VR, biometrics, and eye-tracking into future research can provide significant contributions to evaluating space and spatial design and developing innovative designs in student accommodations and related built environments.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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Abbreviations

The following abbreviations are used in this manuscript:

SQS	Spatial quality satisfaction
PA	Place attachment
ODS	Overall dormitory satisfaction
WoS	Web of Science
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
GSB	Ministry of Youth and Sports
EFF	Evlad-ı Fatihan female
HHF	Hundi Hatun female
ACM	Ahmet Cevdet Pasha male

SSM	Şemseddin Sami male
KLM	Kırklareli male
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
AI	Artificial Intelligence
VR	Virtual Reality

Appendix A

Table A1. Factors and criteria (with explanations) of SQS in student dormitories.

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
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
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
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

Table A1. *Cont.*

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
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
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
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
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
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
EPA7: The overall effect of dormitory spaces on individuals' quality of life

Appendix B

Table A2. 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+
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

Table A2. *Cont.*

Participant Information Questions
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
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 A3. 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.	( )	( )	( )	( )	( )

* Reverse-coded item; SD: Strongly disagree; D: Disagree; N: Neither agree nor disagree; A: Agree; SA: Strongly agree.

Table A4. 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.	( )	( )	( )	( )	( )

Table A4. *Cont.*

	Spatial Quality Satisfaction (SQS)	SD	D	N	A	SA
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.	( )	( )	( )	( )	( )
SOA7	I am satisfied with the 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 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.	( )	( )	( )	( )	( )

Table A4. *Cont.*

	Spatial Quality Satisfaction (SQS)	SD	D	N	A	SA
	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.	( )	( )	( )	( )	( )
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 A5. The "Overall Dormitory Satisfaction Scale" in the survey form.

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

Table A6. Descriptive information regarding the 450 participants in the survey.

Variables	Sub-Variables	n	%
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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