# Performance Assessment of Campus Open Spaces via Post-Occupancy Evaluation (The Case Study of Eram Campus, Shiraz University)*

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## ABSTRACT

Buildings are established to meet the needs and desires of users. The purpose of a building is defeated if its users are not satisfied by the overall building performance. Educational buildings and their environment as centers of progression and innovation are not an exception. The high-quality outdoor spaces of campuses are important for increasing the users' satisfaction. Frequently ignored in texts on campus planning and design, the outdoor spaces deserve far greater attention than they have yet received. This study determines whether the users of the Shiraz University Eram campus are satisfied with overall performance attributes and whether the developed POE could be used as a performance evaluation tool in Shiraz universities' outdoor spaces. The users-based assessment shows that the potential for improving the performance of campus is great. This paper develops a post-occupancy evaluation (POE) framework that integrates open space performance attributes for university campuses and facilities in the city of Shiraz, Iran, based on users' satisfaction. The objectives were to identify the concept of POE in relation to campus performance, to determine the performance level of the outdoor spaces, and the correlation between campus performance and users' satisfaction level. The methodology of this study is adopting an integrated approach in the process of evaluation by combining relevant indicators and variables, retrieved from reviewed literature. All these aspects are molded into the methodology of POE using two surveys (experts' rating and users' satisfaction surveys). Results showed that a significant relationship exists between the campus performance and the users' satisfaction. The correlational results confirmed the relevance of POE as a performance evaluation tool. The findings indicate that the indicators and variables used in assessing the level of campus open space performance are significant in determining levels of users' satisfaction in university campuses and facilities.

**Keywords:** Post-Occupancy Evaluation, Users' Satisfaction, Campus Open Spaces, Shiraz University.

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## 1. INTRODUCTION

Educational buildings and their environment, as centers of progression and innovation, must be accorded with high effective functioning. The presence of high-quality outdoor spaces on the campus is important for increasing the users' satisfaction and facilitating optional, social activities outside the class hours. Architects seldom receive useful feedback about the performance of completed buildings, except from satisfied or dissatisfied clients or users (Mustafa, 2017, p. 413). In order to improve the current situation and provide data for future designs, we must determine the criteria of high-quality spaces inside the university campus and determine users' expectations for the designed areas.

Specialized work and literature about performance assessment of university buildings in relation to their various architectural aspects are lacking. The reason is that academic disciplines do not regard building performance as an area of legitimate interest. (Mustafa, 2017) Many gaps have yet to be bridged. The provision of continuous and specific information that is derived from rigorous evaluative works and empirical evidence to architects and other professionals that are mainly concerned with the design of this type of buildings are either unreliable or non-existent.

Shiraz university was traced its roots in 1946 and was called Pahlavi university. Today, after the occupation in the term of several decades, based on researcher field study and observation, it seems the campus underwent problems and deficiencies related to functional and environmental aspects. This requires in-depth research and studies to diagnose such problems and defects. Among the research trends related to this issue, the post-occupancy evaluation (POE) approach is suitable as a systematic assessment of an occupied building to better understand the effectiveness of certain design elements (Radtke, 2016).

The key purpose of this POE is to investigate, analyze, and report on the successes and weaknesses of the learning environment design to improve buildings and facilities in the future. POE is one of the best practical ways to find and realize obstacles and errors. It is different from other evaluation methods in that it emphasizes the needs and values of building occupants (Preiser & Vischer, 2005). POEs can bring forward both positive and negative aspects of the finished project. Also, lessons can be learned to improve the building or improve the next projects (Ahmadi, Saiki, & Ellis, 2016).

## 2. Problem Formulation

Over the last four decades, many POEs have been conducted on a variety of building types and facilities. Some solutions included increasing the participation of the organization under study and presenting the best results, and better targeting of information to appropriate decision-makers. The existing studies rarely associated users' satisfaction with the performance of university buildings in public and government projects (Mustafa, 2017, p. 414). Based on existing several universities and thousands of students in it, Shiraz city is not an exception. Therefore, this study is an attempt to bridge this gap.

Since performance evaluation of universities has become a global phenomenon over the last decade, from 2015, the Iranian Ministry of Science, Research and Technology (MSRT) has started to evaluate 142 Iranian universities, mainly based on their green activities, and evaluation methods vary from archival research and content analysis to observational research for the selected case studies (Fattahi et al., 2018). The mentioned research project focuses on levels of criteria, indicators, techniques, and tools, and no field research, observations, or interviews with users have been done yet.

The key purpose of this article is to evaluate users' satisfaction, the performance of the campus, and to provide a performance assessment tool that could be used in other Shiraz campuses and therefore making learning environments design more rigorous and systematic in the future.

## 3. Research Aims and Objectives

Based on the research problem, the aim of this research is developing a POE framework that integrates performance attributes of university campus's open spaces in the city of Shiraz based on users' satisfaction. In accordance with the research aim, the objectives of this study are as follows:

A. To determine the performance level of a campus outdoor space in use.

B. To determine the relative levels of users' satisfaction in terms of overall quality and appearance, identity, accessibility, flexibility, comfort and safety.

C. To determine the correlation between the level of campus open space performance attributes and the users' satisfaction level.

## 4. LITERATURE REVIEW

The objective of this research is to identify the concept of post occupancy evaluation (POE) in relation to campus performance, to determine the performance level of the outdoor spaces, and the correlation between campus performance and users' satisfaction level. In this regard, the literature review is concentrated on POE and its types, users' satisfaction as a benchmark in building environment evaluation, and performance requirements of campus outdoor space to retrieve main indicators and a theoretical framework that brings various studies together.

### 4.1. Post Occupancy Evaluation (POE)

Post-occupancy evaluation (POE) conducts the assessment on how the performance of the built environment met the users' needs and can identify

measures to improve overall buildings such as buildings design, performance, and fitness of the buildings. (Wajdi Akashah et al., 2015, p. 28). The data collection of POE is usually done in actual settings rather than in laboratories (Nawawi & Khalil, 2008, p. 62). Preiser, Rabinowitz, and White (1988) defined POE as the process of systematically evaluating the extent to which a facility, once occupied for a period, meets the intended organizational goals and user-occupant needs (Sanni-Anibire & Hassanain, 2016, p. 2). POE provides evidence of a wide range of environmental, social, and economic benefits. It can also address complex cultural issues such as identity, atmosphere, and belonging (Bradbury et al., 2016, p. 6).

The most important benefit of POE is the continuous improvement of the quality and performance of facilities. This is particularly beneficial in projects with reoccurring construction programs or in which a significant number of facilities are typical, such as hospitals and university campuses (Mustafa, 2017, p. 415). POE is different from other techniques because it evaluates all environmental aspects, rather than only focusing on one aspect. POE is basically the approach in evaluating the performance of the environment after the building has been occupied, owned, or used (Khairet et al., 1990, p. 158). According to Masterson (1978), POE describes the quality of the design environment based on the occupant's perception. Thus, POE systematically analyzes the environment and describes whether it will facilitate or complicate the occupants' daily activities (Wu, 2010, p. 180).

Buildings occupants act as a benchmarking tool to improve building performance (Wajdi Akashah et al., 2015, p. 28). Because there is often a documented gap between the planned and actual performance of a building (Menezes et al., 2012), post occupancy evaluation is essential. It can elicit the opinions of buildings' occupants and correlate them with the performance level of the buildings as determined by the POE to verify the credibility of POE as a performance measurement tool (Nawawi & Khalil, 2008, p. 63). Table 1 indicates the different purposes and benefits of POE.

### Table 1. Different Purposes and Benefits of POE

| | |
|---|---|
| Short Term Benefits of POE | • Identification of and finding solutions to problems in buildings;<br>• Response to user needs;<br>• Improve space utilization based on feedback from use;<br>• Understanding of implications on buildings of change whether it is budget cuts or working context;<br>• Informed decision making |
| Medium Term Benefits of POE | • Built-in capacity for building adaptation to organisational change and growth;<br>• Finding new uses for buildings;<br>• Accountability for building performance by designers |
| Longer Term Benefits of POE | • Long-term improvements in building performance;<br>• Improvement in design quality;<br>• Strategic review |

(Blyth & Gilby, 2006)

## 4.2. POE Types Process

Cooper, Ahrentzen, and Hasselkus (1991) describe three different approaches to the POE- indicative, investigative, and diagnostic. In Figure 1, the Post Occupancy Evaluation process model is shown.
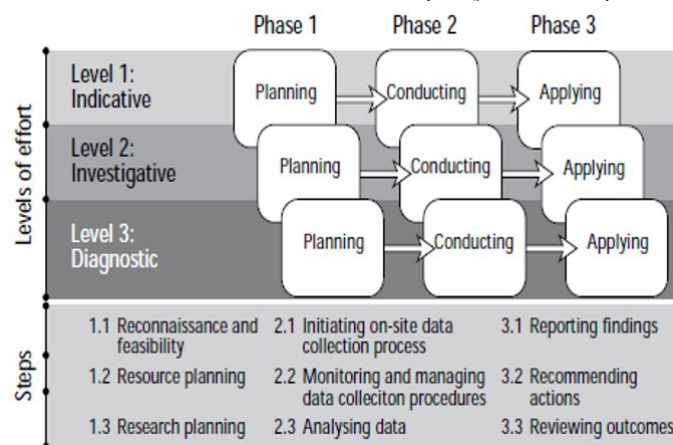


**Fig. 1. Post-Occupancy Evaluation Process Model**
(Cooper et al., 1991, p. 183)

### 4.3. Users' Satisfaction as a Benchmark in Building Environment Performance Evaluation

The terms building satisfaction, building performance, and Post Occupancy Evaluation (POE) are used to describe building evaluation methods. Over time, these methods have developed to include not only the physical and environmental attributes, but also psychological, sociological, economic, and cultural attributes of the occupants (Ishiyaku, Kasim, & Harir, 2017, p. 3). POEs are applied studies intended to affect decisions about how buildings are planned, programmed, designed, built, managed, and maintained (Zimring, 1988, p. 277). Building performance criteria is an expression and translation of client goals and objectives, functions and activities, and environmental conditions that are required. In carrying out these evaluations, three levels of performance are considered:

• The health/ safety/ security level;
• The functionality/ efficiency level;
• The social, psychological, cultural, and aesthetic level (Preiser, 1995, p. 21).

According to the expectancy-disconfirmation theory, which most studies on satisfaction draw on, if the performance of a product or service meets users' or customers' needs and expectations, the user or customer is said to be satisfied with the product and/ or service, and vice versa (Oliver, 1981; Parker & Mathews, 2001). Satisfaction is idiosyncratic and, as a construct, emerges from the interaction of perceptual interpretations of expectations of that service. Thus, different consumers will express varying levels of satisfaction for the same experience. Because culture is the lens, which filters the perceptions of individuals, one can expect the role of culture to be significant in customers' satisfaction ratings. Therefore, depending on the configuration of values in a particular culture, certain behavior types would be more likely than others (Ueltschy, Laroche, Eggert, & Bindl, 2016, p. 412).

Like any other product, buildings are designed and constructed with many expectations by clients, professionals, users, and the community. To clients, buildings require huge capital investment and are expected to bring returns on investment, while to professionals, buildings are products of their creativity and imaginative thinking. The users and community's crucial expectation from buildings is to meet their needs and aspirations by supporting their daily activities and, ultimately, to improve the aesthetic quality of the built environment (Mustafa, 2017, p. 416). In sum, Buildings' occupants act as a benchmarking tool for buildings' performance (Wajdi Akashah, Shah Ali, Fatunah, & Zahari, 2015, p. 28).

### 4.4. Educational Buildings' Outdoor Spaces

Educational Buildings constitute the structural enclosure that enables academic activities to run effectively. The design of modern educational buildings strongly emphasizes stimulating and adaptable learning environments with spaces that support various styles of teaching and learning. Then, educational building design should be adaptive and flexible to accommodate required functional change within the building envelope and its environs (Mustafa, 2017). Building performance evaluation (BPE) helps to ascertain if organizations are managing existing building stock responsibly. By understanding how existing buildings affect occupants, designers can minimize problems and capitalize on successful design features that improve system performance.

Different researchers have suggested and developed models/methodologies that are focused on building's performance of educational facilities. These studies include Preiser et al. (1988), Cash (1993), Kaplan and Norton (1996), Sanoff (2001), Kathsrine and Svein (2004), Zimring et al. (2005), and Alexander (2008). Their methodologies involved data collection tools such as questionnaires, walkthroughs, focus group discussions, interviews, and observations (Mustafa, 2017). The researches mainly focus on educational building performance and the studies on outdoor spaces of learning environments are still lacking.

### 4.5. Performance Requirements of Campus Outdoor Spaces

Over many centuries, different campus plans have emerged; whatever the model selected and whatever the site, location, or region, a campus plan will almost always be some arrangement of buildings with spaces created between them. Frequently ignored in texts on campus planning and design, these outdoor spaces using circulation, study, relaxation, and aesthetic pleasure, deserve far greater attention than they have yet received (Cooper Marcus & Francis, 1998, p. 175). Open spaces located between buildings and working as joints of surrounding environments, provide a sense of direction in a campus by integrating and organizing different places and elements; they also can provide an esthetic sense by involving attractive surroundings and creating visual surprises. Many creative and innovative ideas occur in outdoor environments, away from formal classes and discussions. The natural scenery and a relaxing atmosphere in open spaces encourage impromptu meetings and discussions and provide fresh air for stressed scholars (Siu Yu Laua et al., 2014, p. 453).

University campus has similarities with the urban pattern composed of roads, buildings, and spaces. When these components, as elements of the physical environment, are taken into consideration in terms of the concept of space and structured environment, they may be defined as the environment's utility for individual and social uses (Aydin & Ter, 2008, p. 190). The quality of outdoor spaces supports the relationship between people and increases the quality of urban or university life (Hanan, 2013, p. 310).

Campus designers and planners quickly understood

that they could make spaces that invited interaction and informal learning. Designers have addressed this by working to create campus plans and designs that lead to both social and academic conversations through the placement of buildings, walkways, and amenities (Painter, Fournier, Grape, Grummon, Morelli, Whitmer, & Cevetello, 2012, p. 21). Much of the discussion in campus design and master planning over the past 50 years has been on achieving both "placemaking" and "place marking" on campuses. Placemaking is the structuring of the overall design, the broader skeleton, the articulated pattern, that is, the campus plan. In contrast, place marking involves the definition, conceptualization, and orchestration of certain physical attributes that give a campus a visual uniqueness appropriately its own (Matloob et al., 2014, p. 283; Painter et al., 2012, p. 22).

Understanding that how people perceive the physical environment makes it easier to understand their habits, and helps create more perceptible and memorable places (Turka et al., 2015, p. 340). Identifying and evaluating students' needs in campus spaces are explored to enable the campus spaces to become meaningful places for students. The approach assumes that a good analysis of public space must be initiated by spending time over there, watching how the place is used, and documenting how it feels (Hanan, 2013, p. 309). Table 2 shows the design elements of campus open spaces.

**Table 2. The Design Elements of Campus Open Spaces, Retrieved From Reviewed Literature**

| Theoreticians/ Researchers | Factors |
|---|---|
| (Dober, 1992) | Aesthetic purposes (features such as artworks and sculptures), Functional purposes (noise control, privacy, and reducing erosion), Climatological purposes (shade and air circulation, protection from dusty and hot wind) Place-making (structure, such as open and green spaces, routes for pedestrians and parking), Place marking(trees, outdoor furniture and landmarks) |
| (Evans & Mccoy, 1998; Garling et al., 1986; Stokols, 1992) | Layout, Circulation ,Control, Flexibility, Responsiveness, Privacy, Spatial syntax, Defensible space and Certain symbolic elements |
| (Marcus & Francis, 1998) | Function, Convenience, Safety, Nice, Exhilarating experiences of campus Users' fluency between indoor and outdoor spaces, Suitability for the realization of students' activities, Variety in use |
| (Detr & Cabe, 2000) | Shape, Form, Ecology, Natural features, Colors, and Elements |
| (Carmona, 2003) | Suitable, Soft and Hard landscape |
| (Al-Hagla, 2008) | Social interactions setting, Micro-ecological features |
| (Abd-Razak et al., 2011) | Sense of comfort and welcoming, Better navigation, Attractive scenery, and Safety |
| (Aziz, Azhan, & Abdulah, 2012) | Visual enhancement, Environmental enhancement, and Image enhancement |
| (Hanan, 2013) | Accessibility, Offering clear directions, Suitable appearance and Engaging students on both the outside and the inside, Suitable relationship between spatial structure and users' different activities, Safety, and Security, Encouraging different subgroups for different activities Simultaneously, Comfort, Shaded open spaces, Wind Control, Flexibility, Visual accessibility and Creating a sense of place |
| (Siu Yu Laua, Gou, & Liu, 2014) | Sensation (Lawns, Trees, Colorful plants, Dense planting), Function (Foci, Interaction) |

Faris Ali Mustafa (2017) noted that the focus of a POE could be on three broad categories of performance elements: technical performance elements, functional performance elements, and behavioral performance elements. However, according to (Blyth & Gilby, 2006), the focus of a POE can be considered in terms of process, functional and technical Performance. In this POE study, it is clear that the two main approaches that should be taken into consideration are functional and behavioral, the elements that create a link between occupants' activities and the physical environment.

POE indicators could be categorized by their purpose to serve at various stages of a buildings' lifecycle (Nawawi & Khalil, 2008, p. 62). In general, an indicator is a sign or marker that points to a condition to be measured to evaluate specific qualities (Hasselaar, 2003, p. 23). The indicators and elements retrieved from the various literature review of campuses focusing on the campus outdoor spaces are categorized into six main groups of Overall quality and appearance, Identity, Accessibility, Flexibility, Comfort, and Safety to be analyzed more distinctively (Table 3).

**Table 3. POE Performance Indicators in Campus Open Spaces**

| Criteria | Indicators |
|---|---|
| Overall Quality & Appearance | Appropriate Campus size/ Buildings' layout/ Siting/ Legibility (Hierarchy of open spaces, Hierarchy of walkways, Availability, and quality of signs)/ Circulation Routes (Continuity of walkways, Multiple Choices, Nodes design) |

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| Criteria | Indicators |
|---|---|
| Identity | Local style/ Cultural distinctiveness/ Native plants |
| Accessibility | Accessibility to facilities/ Diversity of routes/ Functional distance/ Permeability/ Ease of finding the way |
| Flexibility | The diverse use of spaces (Different types of necessary, Optimal and social activities)/ Responsiveness to changes in different times |
| Comfort | Ease of movement (Walkway width & slope, Paving quality, Ease of access for people with disabilities)/ Climatic comfort/ Semi-private spaces/ Suitable arrangement of furniture/ Comfortable Seating |
| Safety | Separating pavement from the street/ Defensive open spaces (Well-lit at night, Visual accessibility)/ Appropriate quantity of users |

## 5. METHODOLOGY

The research method of this study is mixed, comprising qualitative and quantitative methods. The qualitative part is mainly concentrated on observation of the campus site and layout focusing on landmarks, road accesses, gates, and most used spaces. Main activities in the frequently used spaces and users' reasons for choosing these areas were the most considerable issues in deep interviews. In the quantitative part, relevant indicators and variables retrieved from reviewed literature and field study are molded into the methodology of POE using two questionnaire surveys (experts' rating and users' satisfaction surveys).

### 5.1. Eram Campus, Shiraz University

Shiraz university was traced its roots in 1946 and was called Pahlavi university that the Shah hoped this institution would become a shining beacon of higher education excellence in the Middle East (http://shirazu. ac.ir, 2019; Garlitz, 2008; http://caoi.ir, 2019).

After a sequence of working a team of advisors from the University of Pennsylvania with Iranian higher education elites, constructing a statistical model by Minoru Yamasaki, and presenting a proposal by Aalto, Shiraz University was built with the design of Mohammad Reza Moghtader in 1975-1980. Today it consists of 11 colleges and 3 junior colleges. It is one of the major universities of Iran and it has always ranked as Top 5 among Iranian universities and is well respected in Iran. (Kooros, 1962; Baani Masoud, 2012, pp. 332-333). Figures 2-5 and Table 4 show the most used open spaces on the campus. The assessment resulted from the authors' observation and several interviews with students.
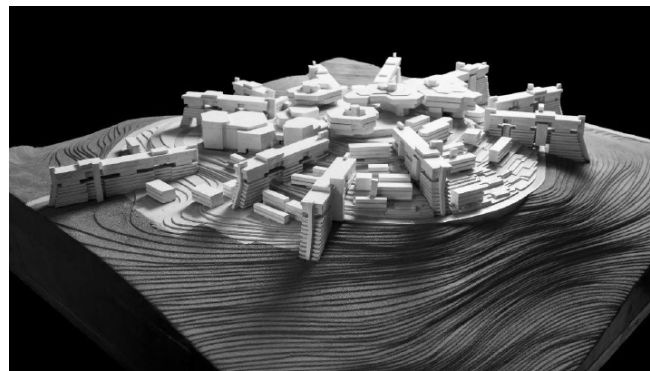


**Fig. 2. Main Concept of Central Library and Dormitories (McMillan Associates)**
(Fattahi et al., 2018)



Eram Hall
Hekmat Hall
Central Library
Mofatteh Dormitory
Theology Faculty
Chamran Dormitory
Dastgheib Dormitory

**Fig. 3. General View of Eram Campus**

**Fig. 4. Eram Campus Open Spaces**
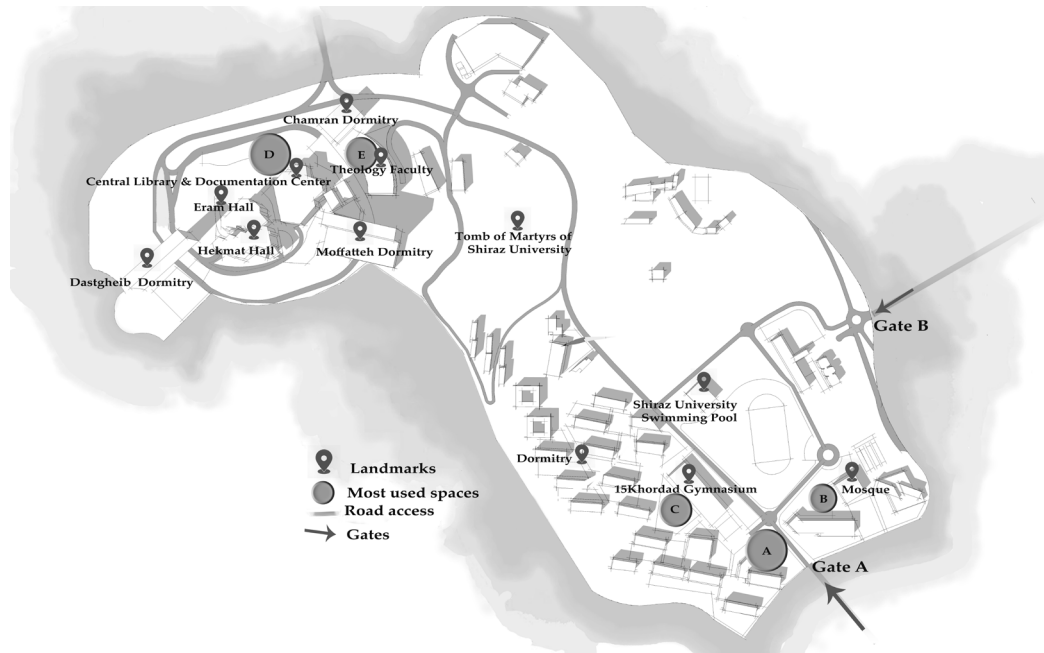


**Fig. 5. Map Showing Landmarks, Road Access, Gates & Most Used Spaces**

**Table 4. Most Used Open Spaces in the Eram Campus, Shiraz University**

| Selected Open Space | Surroundings | Location | Landscape Design and Furniture | Main Activities | Reason for the Choice |
|---|---|---|---|---|---|
|  | A | Front of the main market | Trees Lawns | Eating/ Sitting and rest/ Chatting/ Group and informal activities | • Appropriate accessibility<br>• Proximity to the dormitory<br>• Being public and holding social activities<br>• Shadow, trees and lawns |
|  | B | Next to the Mosque | Trees Lawns | Passing-by/ Eating/ Sitting and rest/ Chatting | • Security, Calmness<br>• Appropriate accessibility<br>• Shadow & Sunshine<br>• Enclosure & Feeling cozy |

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| Selected Open Space | Surroundings | Location | Landscape Design and Furniture | Main Activities | Reason for the Choice |
|---|---|---|---|---|---|
| C | | Inside the Dormitory and Next to the 15 Khordad Gymnasium | Trees Lawns | Exercise/ Eating/ Sitting and rest/ Chatting/ Enjoying scenery | • Sports facilities<br>• Calmness & Silence<br>• Variety of vegetation<br>• Well-lit<br>• Safety<br>• Beautiful outlook |
| D | | Next to the Central Library and Documentation Center | Trees Lawns Benches | Enjoying scenery/ Eating/ Sitting and rest/ Chatting/ Studying | • Beautiful outlook<br>• Enclosure & Feeling cozy<br>• Appropriate vegetation<br>• Good furniture<br>• Shadow & Sunshine<br>• Well-lit & Safety<br>• Calmness & Silence<br>• Appropriate for social interaction |
| E | | The Roof of the Theology Faculty | - | Enjoying scenery Sitting and rest Chatting | • Beautiful outlook<br>• Appropriate for social interaction |

## 5.2. Questionnaire Surveys

This study's methodology was based on users' satisfaction and the quality of place in Shiraz University, Eram campus. According to this aim, first, a library search was done. Then, based on the findings of the literature review, the items of the questionnaire were retrieved to evaluate users' satisfaction, building performance level, and their correlation.

The questionnaire form consists of 15 questions. The alternative answers for the quality of components were divided into five Likert scale categories: very dissatisfied, dissatisfied, neither dissatisfied nor satisfied, satisfied and very satisfied. The pilot study needs to be conducted right before questionnaires distribution. It is important to evaluate the efficiency and adequacy of the sampling. After conducting the pilot study, a total of 140 questionnaires were distributed via email or hand-delivered among both students and experts. The details are shown in Table 1. The experts were the faculty members of Architecture & Urbanism (Urban Design & Urban Planning) departments, Shiraz University.

**Table 5. Questionnaire Respondents**

| Participants | Frequency | Percent |
|---|---|---|
| Students | 120 | 85.71 |
| Experts | 20 | 14.28 |
| Total | 140 | 100 |

SPSS (version 24) software was used for statistical analysis in this article. Both descriptive and inferential data analysis techniques were used such as frequencies, mean, skewness, kurtosis, Shapiro-wilk test, and Spearman correlation test. At first, the alpha coefficient was calculated for 15 items; and it was shown 0.949, which is higher than 0.7. It indicates a high internal consistency and is acceptable. (Table 6).

**Table 6. Reliability Statistics**

| Cronbach's Alpha | N of Items |
|---|---|
| 0.949 | 15 |

## 6. ANALYSIS AND EVALUATION

In this section, the relationship between campus open space performance level (based on the experts' rating) and users' satisfaction level is measured. This measurement is based on a score analyzing fifteen POE indicators that are categorized into six main parts includes overall quality and appearance, Identity, Accessibility, Flexibility, Comfort, and Safety. Furthermore, the relevance of POE as a performance evaluation tool is assessed.

## 6.1. Campus Open Space Performance Level Based on the Experts' Rating

The level of campus open space performance was assessed according to experts' rate. It was measured using a score based on the quality of 15 different elements. The total of their rate is 3.19 that indicates a score higher than moderate, and it denotes that the quality of the Eram campus is good. (M ≤ 1: very poor, 1 < M ≤ 2: Poor, 2 < M ≤ 3: barely acceptable, 3 < M ≤ 4: Good, 4 < M ≤ 5: very good).

In this research, POE elements were categorized into six indicators included: Overall quality and appearance, Identity, Accessibility, Flexibility, Comfort, and safety. Table 7 shows indicators and performance level based on the mean of each item. The level score of all indicators is higher than moderate except comfort, which is 2.90. It is slightly less than moderate. According to the category, the performance level about comfort is barely acceptable. Figure 6 summarizes the mean of all indicators related to experts' rating.
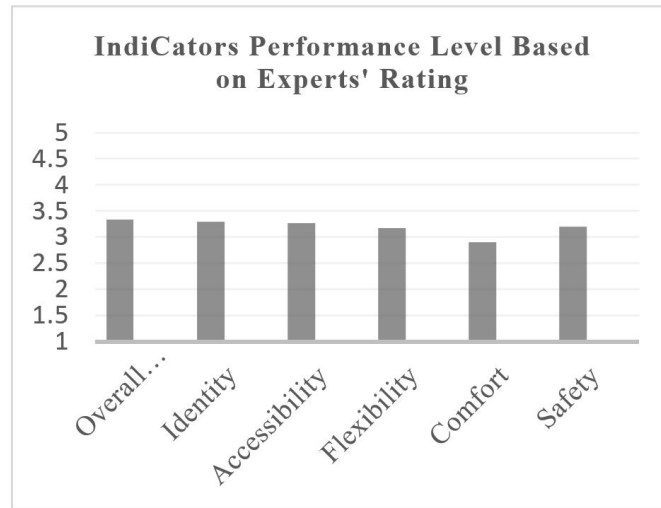


**Fig. 6. The Mean of Each Indicator According to Experts' Rating**

**Table 7. Results of the Building Performance Review Based on the Experts' Rating**

| Building Performance Level % | | VP | P | BA | G | VG | Mean | |
|---|---|---|---|---|---|---|---|---|
| Overall Quality and Appearance | Buildings' and Open Spaces' Spatial Configuration | 0 | 25 | 50 | 10 | 15 | 3.15 | 3.33 |
| | Overall Quality, Appearance and Presentation of the Buildings And Open Spaces | 0 | 20 | 30 | 35 | 15 | 3.45 | |
| | Suitable Arrangements in Open Spaces to Encourage Presence of Students | 10 | 20 | 25 | 35 | 10 | 3.15 | |
| | Diverse Green Spaces Such as Lawns, Trees, Colorful Plants and Dense Plantations | 5 | 10 | 30 | 35 | 20 | 3.55 | |
| | Visual Accessibility by Plants to Create Unimpeded Spaces | 5 | 25 | 10 | 50 | 10 | 3.35 | |
| Identity | Local Style, Enhancing Local Identity and Culture | 5 | 30 | 15 | 30 | 20 | 3.30 | 3.30 |
| Accessibility | Diversity of Routes, Offering Clear Directions to Entries | 5 | 20 | 35 | 30 | 10 | 3.20 | 3.27 |
| | Accessibility to Campus Facilities | 0 | 20 | 35 | 35 | 10 | 3.35 | |
| Flexibility | Relationship between Open Spaces Spatial Structure and Students' Different Activities | 5 | 25 | 35 | 20 | 15 | 3.15 | 3.17 |
| | Provide Open Spaces with Opportunity of Diverse Activities in Different Times | 10 | 25 | 15 | 35 | 15 | 3.20 | |
| Comfort | Providing Walkways with Standard Circulation, Width, and Slope | 0 | 40 | 30 | 15 | 15 | 3.05 | 2.90 |
| | Easy Access by People with Disabilities | 35 | 20 | 25 | 10 | 10 | 2.40 | |
| | Providing Shaded Open Space and Creating Sun Traps by Buildings' Walls Or Planting | 5 | 25 | 25 | 30 | 15 | 3.25 | |
| Safety | Separating Pavement From The Street | 0 | 10 | 45 | 30 | 15 | 3.50 | 3.20 |
| | Proper Lighting, Safe, and Comfortable Night-Time Environment | 15 | 15 | 45 | 15 | 10 | 2.90 | |

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## 6.2. Users' Satisfaction Level

This part of the research determined the satisfaction level of users. Similar to the first part, 15 factors were evaluated and the overall mean of satisfaction of 120 users was calculated as 3.03. This part also was interpreted in six indicators. Figure 7 summarizes the mean of each indicator related to users' satisfaction. Table 8 also illustrates the percentage of the users' satisfaction and the mean of each item. According to Figure 7 and Table 8, users' satisfaction level of identity and comfort is lower than moderate.

**Table 8. Eram Campus Users' Satisfaction Level**

| Users' Satisfaction Level % | | VD | D | MS | S | VS | Mean | |
|---|---|---|---|---|---|---|---|---|
| Overall Quality and Appearance | Buildings' and Open Spaces' Spatial Configuration | 7.5 | 10.8 | 45 | 26.7 | 10 | 3.21 | 3.20 |
| | Overall Quality, Appearance, and Presentation of the Buildings and Open Spaces | 5 | 8.3 | 45.8 | 29.2 | 11.7 | 3.34 | |
| | Suitable Arrangements in Open Spaces to Encourage Presence of Students | 14.3 | 21.8 | 30.3 | 19.3 | 14.3 | 2.97 | |
| | Diverse Green Spaces Such as Lawns, Trees, Colorful Plants, and Dense Plantations | 7.5 | 10.8 | 30 | 32.5 | 19.2 | 3.45 | |
| | Visual Accessibility by Plants to Create Unimpeded Spaces | 5.1 | 16.9 | 45.8 | 23.7 | 8.5 | 3.14 | |
| Identity | Local Style, Enhancing Local Identity and Culture | 20.8 | 27.5 | 25 | 19.2 | 7.5 | 2.65 | 2.65 |
| Accessibility | Diversity of Routes, Offering Clear Directions to Entries | 10.1 | 22.7 | 29.4 | 30.3 | 7.6 | 3.03 | 3.01 |
| | Accessibility to Campus Facilities | 8.3 | 24.2 | 36.7 | 21.7 | 9.2 | 2.99 | |
| Flexibility | Relationship between Open Spaces Spatial Structure and Students' Different Activities | 5 | 14.2 | 44.2 | 25 | 11.7 | 3.24 | 3.20 |
| | Provide Open Spaces with Opportunity of Diverse Activities in Different Times | 4.2 | 21.8 | 37 | 27.7 | 9.2 | 3.16 | |
| Comfort | Providing Walkways with Standard Circulation, Width, and Slope | 18.3 | 22.5 | 33.3 | 15.8 | 10 | 2.77 | 2.77 |
| | Easy Access by People with Disabilities | 31.1 | 24.4 | 24.4 | 10.9 | 9.2 | 2.43 | |
| | Providing Shaded Open Space and Creating Sun Traps by Buildings' Walls or Planting | 13.3 | 17.5 | 29.2 | 25 | 15 | 3.11 | |
| Safety | Separating Pavement From the Street | 5.9 | 25.2 | 28.6 | 31.9 | 8.4 | 3.12 | 3.01 |
| | Well-Lit, Safe and Comfortable Night-Time Environment | 11.8 | 22.7 | 39.5 | 16 | 10.1 | 2.90 | |
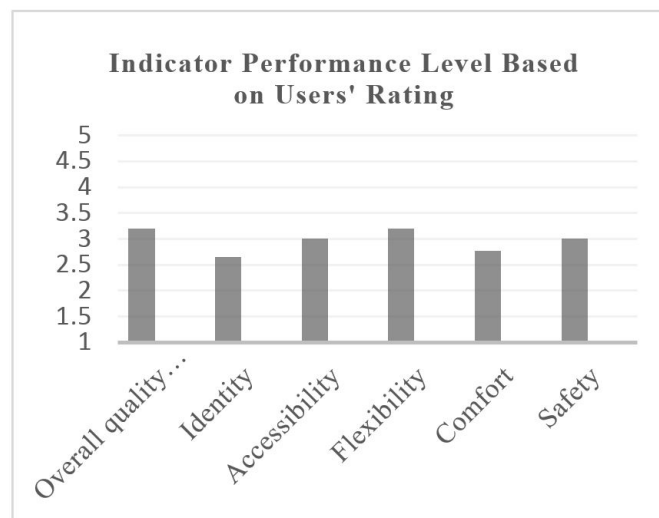


**Fig. 7. Mean of Indicators According to Users' Rating**

## 6.3. Correlation Coefficient of Building Performance and Users' Satisfaction

The final section of the analysis involves finding the correlation coefficient of the Eram campus users' satisfaction in relation to the open space quality. Figure 8 compares building performance level and users' satisfaction to the overall building attributes and items.
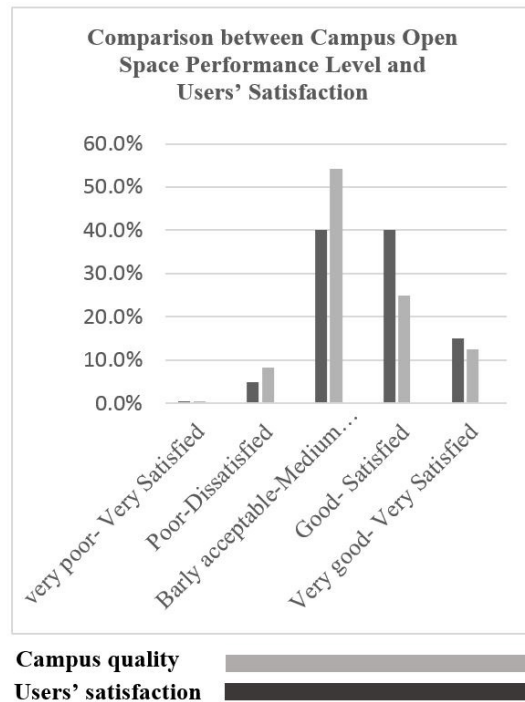


**Fig. 8. Comparison between Campus Open Space Performance Level and Users' Satisfaction to the Overall Campus Attributes**

At first, skewness, kurtosis, and Shapiro-Wilk tests were done to determine whether datasets were normal. Since the datasets were not normal, Spearman's correlation coefficient was used as a nonparametric test. A correlation coefficient higher than 0.5 appeared to be a high positive correlation between building performance level and users' satisfaction (correlation ≥ 0.8: very high, correlation ≥ 0.5: high, correlation< 0.5: low). Figure 9 illustrates Spearman's correlation.

This obvious relationship between the two variables supports the research hypothesis that a significant relationship exists between the campus performance and users' satisfaction. Both results in the correlational analysis reveal significant relationships between building performance and users' satisfaction level. The correlational outcome only offers the value of coefficient and the strength of relationship and expectations against the reasons, and the conclusion should be identified from the analysis. This study assumes that the users' satisfaction level depends on the building performance level in their university environment. This correlational outcome is a vital confirmation of the efficiency of POE as a tool in assessing the performance of the built environment and campus open spaces.
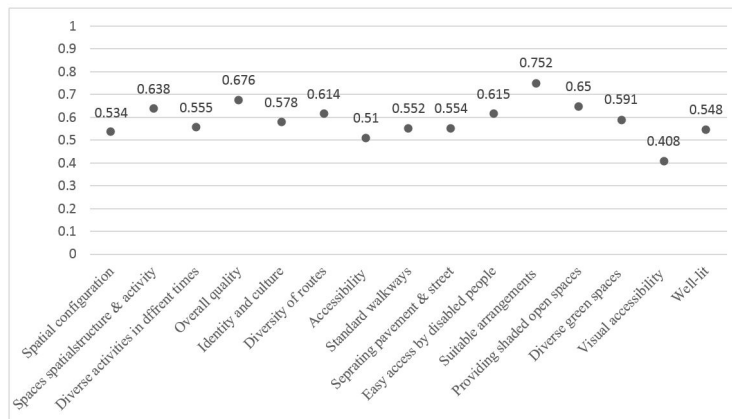


**Fig. 9. Correlation between Campus Performance Level and Users' Satisfaction**

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## 7. DISCUSSION & CONCLUSION

Based on the analysis, the compelling correlational results confirm the relevance of POE as a campus performance tool for a selected campus in the city of Shiraz, Iran. The scientific contribution of this study lies in adopting an integrated approach in the process of evaluation by combining numerous indicators and relevant variables used in assessing various aspects of built environment performance, such as functional and behavioral. All these aspects are molded into the methodology of POE using two surveys (experts' rating and users' satisfaction surveys).

The analysis of the findings confirms that the application of POE is pertinent, effective, and successful in determining the users' satisfaction level and providing recommendations for improving campus performance.

• This approach has great potential for analyzing building performance, because the campus users' behavior, insights, and opinions are integrated.

• POE also plays a crucial role in the strategic planning of building management and can be placed in the context of the public sector. POE can reduce the appearance of defective problems because the process allows a strategic assessment of the current performance of the building.

• The presence of high-quality outdoor spaces on the campus is important for increasing the users' satisfaction and facilitating optional social activities outside the class hours. To improve the current situation and provide data for future designs, we must determine users' expectations for the designed areas. Therefore, the campus design should consider retrieved factors and sub-factors that will determine the efficient performance of the campus consistent with the high satisfaction of the users.

• The findings denotes that the indicators and variables of Overall quality and appearance, Identity, Accessibility, Flexibility, Comfort, and Safety used in assessing the campus performance level are significant in determining the levels of users' satisfaction in university buildings and facilities. The findings show that the indicators and their attributes and items related to building performance have a high correlation with the building users' satisfaction levels (Fig. 10).
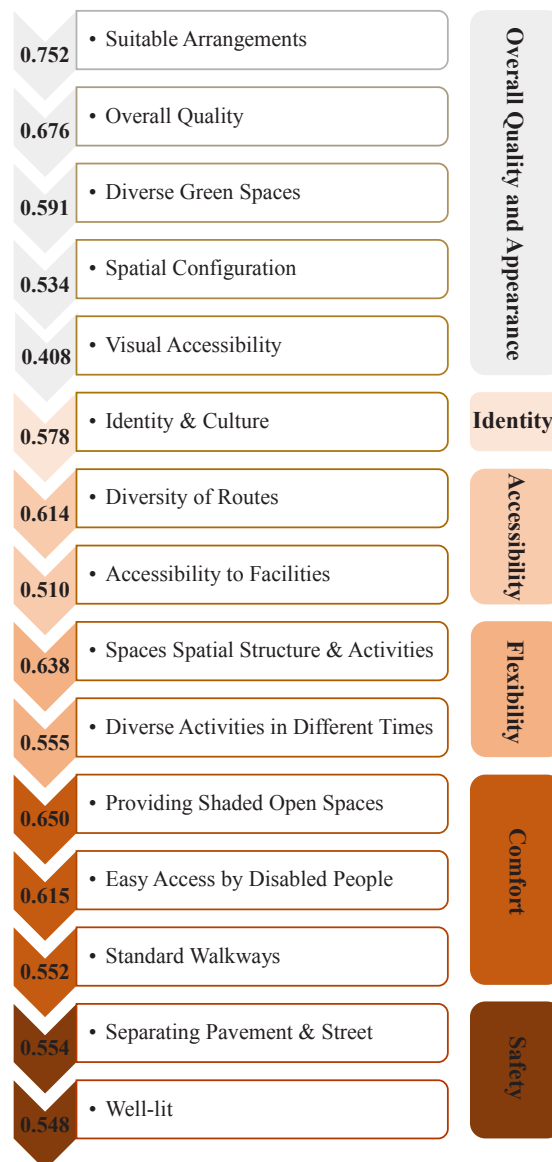
| | | |
|---|---|---|
| 0.752 | • Suitable Arrangements | Overall Quality and Appearance |
| 0.676 | • Overall Quality | |
| 0.591 | • Diverse Green Spaces | |
| 0.534 | • Spatial Configuration | |
| 0.408 | • Visual Accessibility | |
| 0.578 | • Identity & Culture | **Identity** |
| 0.614 | • Diversity of Routes | Accessibility |
| 0.510 | • Accessibility to Facilities | |
| 0.638 | • Spaces Spatial Structure & Activities | Flexibility |
| 0.555 | • Diverse Activities in Different Times | |
| 0.650 | • Providing Shaded Open Spaces | Comfort |
| 0.615 | • Easy Access by Disabled People | |
| 0.552 | • Standard Walkways | |
| 0.554 | • Separating Pavement & Street | Safety |
| 0.548 | • Well-lit | |

**Fig. 10. High Correlation between the Campus Performance (Experts' Rates) and Users' Satisfaction**

As discussed before, an investigative approach is used in this research. This approach was selected based on the expected outcome and the limitations of observation time and lack of students' cooperation for an in-depth interview. Although the outcome of the investigation is coincident with the research findings and data analysis, this study can be also done with the diagnostic approach and more comprehensive analysis of the facility's environmental and occupant system.

To conclude, this study adds to the empirical evidence that the users' perception of university open space and facility environment cannot be discountenanced at the policy, planning, design, and implementation phases. Although the research findings are consistent with previous studies that have been done on POE as a valuable methodology to analyze buildings' performance in general, the studies rarely associated with users' satisfaction in campus open spaces in Iran. POE is different from other evaluation methods in that it emphasizes the needs and values of building occupants. It can bring forward both positive and negative aspects of the finished project. Also, lessons can be learned to improve the building or improve the next projects. Therefore, performance assessment in the other educational spaces is a good study to be investigated using this research method. Using POE as the best practical way to find and realize obstacles and errors, providing focused recommendations and detailed design patterns for improving campus's performance can be great applied research that is recommended as a further study.

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# REFERENCES

– Ahmadi, R., Saiki, D., & Ellis, C. (2016). Post Occupancy Evaluation an Academic Building: Lessons to Learn. Applied Scinces and Art. Https://Opensiuc.Lib.Siu.Edu/Jasa/Vol1/Iss2/4/

– Aydin, D., & Ter, U. (2008). Outdoor Space Quality: Case Study of a University Campus Plaza. *Archnet*, 189-203. Https://Archnet.Org/Publications/5183

– Baani Masoud, A. (2012). Iranian Contemporary Architecture. Tehran: Honar-E Memari Press.

– Blyth, A., & Gilby, A. (2006). Guide to Post Occupancy Evaluation. University of Westminister.

– Bradbury, S., Dixon, D., Matindale, K., Samuel, F., & Tait, A. (2016). Pathways to POE,Value of Architects. University of Reading, RIBA.

– Cooper Marcus, C., & Francis, C. (1998). People Places: Design Guideline for Urban Open Space. Published by John Wiley & Sons. Inc. Published Simultaneously In Canada.

– Cooper, B., Ahrentzen, S., & Hasselkus, B. (1991). Post-Occupancy Evaluation: An Environment-Behaviour Technique for Assessing the Built Environment. *Canadian Journal of Occupational Therapists*, 181-188. Https://Doi.Org/10.1177/000841749105800406

– Fattahi, K., Ekhtiari, M., Bannazadeh, B., Dashti, S., & Zamani, Z. (2018). Study the Contextual Approach of Greening Campus Evaluation and Ranking Model in Iran. Stockholm: ISCN 12th Annual Conference.

– Garlitz, R. (2008). Academic Ambassadors in the Middle East: The University Contract Program in Turkey and Iran, 1950-1970. Phd Thesis, The College of Arts and Sciences of Ohio University.

– Hanan, H. (2013). Open Space as Meaningful Place for Students in ITB Campus. Social and Behavioral Sciences, 308-317. Https://Cyberleninka.Org/Article/N/1005082

– Hasselaar, E. (2003). Health Performance Indicators of Housing. *Proceeding of Healthy Buildings*, (23-29).Http://Www.Caoi.Ir/En/Projects/Item/51-Shiraz-Art-Museum-Alvar-Aalto.Html#Description Http://Shirazu.Ac.Ir

– Ishiyaku, B., Kasim , R., & Harir, A. (2017). Confirmatory Factoral Validity of Public Housing Satisfaction Constructs. *Business & Management*, 1-17. Https://Doi.Org/10.1080/23311975.2017.1359458

– Khair, N., Ali, H., Sipan, I., Hafizah Juharia, N., & Daud, S. (1990). Post Occupancy Evaluation of Physical Environment in Publc Low-Cost Housing. *Journal Teknologi*, 155-162. Https://Doi.Org/10.11113/Jt.V75.5284

– Kooros, J. (1962). Pahlavi University, Shiraz, Iran. Massachusettes Institute of Technology: In Partial Fulfillment of the Requirements for the Degree of Master of Architecture.

– Matloob, F., Sulaiman, A., Hasan Ali, T., Shamsuddin, S., & Mardyya, W. (2014). Sustaining Campuses through Physical Character- The Role of Landscape. *Social and Behavioral Sciences*, 282-290.

– Menezes, A., Cripps, A., Bouchlaghem, D., & Buswell, R. (2012). Predicted Vs. Actual Energy Performance of Non-Domestic Buildings: Using Post-Occupancy Evaluation Data to Reduce the Performance Gap. *Applied Energy*, 355-364.  Http://Www.Sciencedirect.Com/Science/Article/Pii/S0306261911007811

– Mustafa, F.A. (2017). Performance Assessment of Buildings Via Post-Occupancy Evaluation: A Case Study of the Building O the Architecture and Software Engineering Departments in Salahaddin University-Erbil, Iraq. *Frontiers of Architectural Research*, 412-429.

– Nawawi, A., & Khalil, N. (2008). Post-Occupancy Evaluation Correlated With Building Occupants ' Satisfaction: An Approach to Performance Evaluation of Government and Public Buildings. *Journal of Building Appraisal*, 4, 59-69.

– Oliver, R. (1981). Measurement and Evaluation of Satisfaction Process in Retail Setting. *Journal of Retailing*, 25-48.

– Painter, S., Fournier, J., Grape, C., Grummon, P., Morelli, J., Whitmer, S., & Cevetello, J. (2012). Research on Learning Space Design:Present State, Future Directions. Perry Chapman Prize.

– Parker, C., & Mathews, B. (2001). Customer Satisfaction: Contrasting Academic and Consumers' Interpretations. *Marketing Intelligence & Planning*, 38-46. DOI: 10.1108/02634500110363790

– Preiser, W. (1995). Post-Occupancy Evaluation: How to Make Buildings Work Better. *Facilities*, 21-33.

– Preiser, W., & Vischer, J. (2005). Assessing Building Performance. Jordan Hill, Oxford: Elsevier Butterworth-Heinemann.

– Radtke, R. (2016). Evaluating Living and Learning on Campus: A Community Engaged Research Model. 50th Anniversary Conference. Brighton-UK.

– Sanni-Anibire, M., & Hassanain, M. (2016). Quality Assessment of Student Housing Facilities through Post-Occupancy Evaluation. *Architectural Engineering and Design Management*, 1-14. Https://Doi.Org/10.1080/17452007.2016.1176553

– Siu Yu Laua, S., Gou, Z., & Liu, Y. (2014). Healthy Campus by Open Space Design: Approaches and Guidelines. *Frontiers of Architectural Research*, 452-467.

– Turka, Y., Sena, B., & Ozyavuzb, A. (2015). Students Exploration On Campus Legibility. *Social And Behavioral Sciences*, 339-347. Https://Doi.Org/10.1016/J.Sbspro.2015.07.147

– Ueltschy, L., Laroche, M., Eggert, A., & Bindl, U. (2016). Service Quality And Satisfaction: An International Comparison of Professional. *Journal of Services Marketing*, 410-423.

– Wajdi Akashah, F., Shah Ali, A., Fatunah, S., & Zahari, M. (2015). Post-Occupancy Evaluation (POE) of Conventional-Designed Buildings: The Effects of Occupants' Comfort on Productivity. *Journal Teknologi*, 27-37.

– Wu, F. (2010). Housing Environment Preference of Young Consumers in Guangzhou, China: Using the Analytic Hierarchy Process. *Property Management*, 174-192.

– Zimring, C. (1988). Post-Occupancy Evaluation and Implicit Theories of Organizational Decision-Making. Proceding of the 19th Annual Conference of Environmental Design Research Association, (277-280). California.