DEVELOPMENT OF POST-OCCUPANCY DESIGN EVALUATION TECHNIQUE AS A DESIGN STUDIO CRITERIA FOR FUTURE OPEN-PLAN SYSTEM

By

NURSYUHADA BINTI SUAIMI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

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DEDICATION

Special dedication to:

This research work is dedicate to my beloved father ***Suaimi Bin Tahir*** *and my mother* ***Aminah Binti Zainal Abidin*** *also to my lovely husband* ***Mohamad Azri Bin Sabtu*** *for their excellence encouragement, compassion, guidance and constant prayers during the course of my study. I also dedicate this research work to my beloved son* ***Luth Anaqi Bin Mohamad Azri.***

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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NURSYUHADA BINTI SUAIMI

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Chairman : Associated Professor Ts Mohd Shahrizal bin Dolah, PhD
Faculty : Design and Architecture

Open-plan System (OPS) furniture nowadays becoming a trend for student's design studios in Malaysia university. Currently, there were no specific design criteria for OPS used by students. Besides, there was no standard evaluation technique to validate the relevancy of the product to the current user. There is a need to review the existing design criteria of OPS furniture used by students. To sustain the product quality in the future, the developed priority of design criteria will be used to create an evaluation form technique that is called Post-Occupancy Design Evaluation™ (PODE). This study seeks to identify the priority of design criteria of the OPS furniture for students used. This study also develops the PODE™ technique of OPS furniture standard guidance design criteria for students used. This study adopted a mixed- method approach. The first is qualitative method used in this study was through the researcher's experience as a student, review of literature, close-ended interview to gain the Designer Voice (DV), Participatory Design (PD) to gain the User Voice (UV), and pilot test on the Design Evaluation (DE) survey form development. While the quantitative method used in this study through the DE survey to identify the priority of design criteria of OPS furniture and the top rank of user's requirement. The DE Form is a novel approach by the researcher that adopting the structure of House of Quality (HOQ) in Quality Function Deployment (QFD) approach. This study revealed that the priority of design criteria lead by the usability while sketching, ergonomic of the table, aesthetic in color, and function in flexibility. Other than that, the result also reveals that the user requirement *change height and angle of a table for sketching* has majority voted through the DE analysis. The PODE™ form has adopted the concept of the Post-Occupancy Evaluation (POE) which is focused on design evaluation as a template for a designer to evaluate the design in the future. It can be summarized that the priority of design criteria of OPS furniture used by the student are gained from the user's opinion and thought which led to user satisfaction. PODE™ technique contributes to stakeholders for future furniture planning for student's studio which are

the standard guidance for the designer to refer in future furniture design that will provide a quality product that meets the student's needs.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

PEMBANGUNAN TEKNIK PENILAIAN REKA BENTUK POS-KERJA SEBAGAI KRITERIA STUDIO REKA BENTUK UNTUK SISTEM PELAN TERBUKA MASA DEPAN

Oleh

NURSYUHADA BINTI SUAIMI

Mei 2021

Pengerusi : Professor Madya Ts Mohd Shahrizal bin Dolah, PhD
Fakulti : Rekabentuk dan Senibina

Perabot Sistem Pelan Terbuka (OPS) kini menjadi trend untuk studio reka bentuk pelajar di universiti Malaysia. Pada masa ini, tidak ada kriteria reka bentuk khusus untuk OPS yang digunakan oleh pelajar. Di samping itu, tidak ada teknik penilaian standard untuk mengesahkan kesesuaian produk dengan pengguna semasa. Terdapat keperluan untuk mengkaji semula kriteria reka bentuk perabot OPS yang ada yang digunakan oleh pelajar. Untuk mengekalkan kualiti produk di masa depan, kriteria reka bentuk keutamaan yang dikembangkan akan digunakan untuk membuat teknik bentuk penilaian yang disebut Penilaian Rekabentuk Pasca-Pekerjaan™ (PODE). Kajian ini bertujuan untuk mengenal pasti kriteria reka bentuk keutamaan perabot OPS untuk kegunaan pelajar. Kajian ini juga mengembangkan teknik PODE™ kriteria reka bentuk bagi panduan standard perabot OPS untuk pelajar yang digunakan. Kajian ini menggunakan pendekatan kaedah campuran. Kaedah kualitatif yang digunakan dalam kajian ini adalah melalui pengalaman penyelidik sebagai pelajar, tinjauan literatur, wawancara tertutup untuk memperoleh Suara Pereka (DV), Reka Bentuk Partisipatif (PD) untuk mendapatkan Suara Pengguna (UV), dan ujian rintis pada pembangunan borang tinjauan Evaluasi Reka Bentuk (DE). Sementara itu, kaedah kuantitatif yang digunakan dalam kajian ini melalui tinjauan DE untuk mengenal pasti keutamaan kriteria reka bentuk perabot OPS dan peringkat tertinggi keperluan pengguna. Borang DE adalah pendekatan baru oleh pengkaji yang mengadopsi struktur House of Quality (HOQ) dalam pendekatan Quality Function Deployment (QFD). Kajian ini mendedahkan bahawa kriteria reka bentuk keutamaan dipimpin oleh kebolehgunaan semasa membuat lakaran, ergonomis meja, estetika warna, dan fungsi dalam fleksibilitas. Selain itu, hasilnya juga menunjukkan bahawa keperluan pengguna mengubah ketinggian dan sudut meja untuk membuat lakaran telah memilih sebahagian besar melalui analisis DE. Borang PODE™ diadopsi konsep Penilaian Pasca-Pekerjaan (POE) yang memfokuskan pada penilaian reka bentuk sebagai templat untuk pereka untuk menilai reka bentuk di masa depan. Dapat disimpulkan bahawa kriteria reka bentuk keutamaan perabot OPS yang digunakan oleh pelajar diperoleh

dari pendapat dan pemikiran pengguna yang menyebabkan kepuasan pengguna. Teknik PODE™ memberi sumbangan kepada pihak berkepentingan untuk perancangan perabot masa depan untuk studio pelajar yang merupakan panduan standard bagi pereka untuk merujuk reka bentuk perabot masa depan yang akan memberikan produk berkualiti yang memenuhi keperluan pelajar.

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This thesis was submitted to the Senate of the Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Mohd Shahrizal bin Dolah, PhD
Associate Professor Ts
Faculty of Design and Architecture
Universiti Putra Malaysia
(Chairman)

Saiful Hasley bin Ramli, PhD
Senior Lecturer Ts
Faculty of Design and Architecture
Universiti Putra Malaysia
(Member)

YM Raja Ahmad Azmeer bin Raja Ahmad Effendi, PhD
Associate Professor
Faculty of Design and Architecture
Universiti Putra Malaysia
(Member)

Jusang bin Bolong, PhD
Professor
Faculty of Modern Languages and Communication
Universiti Putra Malaysia
(Member)

ZALILAH MOHD SHARIFF, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date: 11 August 2022

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LIST OF ABBREVIATIONS

AV	Average
CL	Cumulative
DC	Design Criteria
DE	Design Evaluation
DP	Design Priority
DV	Designer Voice
ED	Expert Designer
FRSB	Faculty of Design and Architecture
HOQ	House of Quality
OPS	Open-plan System
PD	Participatory Design
POE	Post-Occupancy Evaluation
PODE	Post-Occupancy Design Evaluation™
QFD	Quality Function Deployment
RO1	Research Objective 1
RO2	Research Objective 2
RQ1	Research Question 1
RQ2	Research Question 2
UPM	University Putra Malaysia
UV	User Voice

CHAPTER 1

INTRODUCTION

1.1 Background of the study

In the last decade, designing work has become a complex process. Traditionaly, designer focuses on outlook and functions. Despite this, the most essential thing should be consider for the user's need. The term "end-user" refers to the individual who will eventually use the manufactured product. Any user feedback should be regarded as factors in the design process's progress. Product creation requires the validation phase that designers need to know about their product design input from the user. However, there are no specific assessment form to verify the end consumer's product in furniture design. In architecture, the Post-Occupancy Evaluation (POE) was the usual method for validating a building after it had been occupied by humans. Lawrence and Keime (2016) state that, to improve the low-energy design, feedback measures such as POE are becoming more popular as they encourage dialogue between designers and occupants, and provide a basis for future design assumptions. Therefore, this kind of evaluation will give space for designers to communicate with the users. The assessment should have all the design criteria attribute that meets users need.

Design criteria develop a relationship with the user's needs through the product development process. Design criteria is an attribute that can be measure for a product. To produce a good product design, designers should be aware of the real needs of users. Enhancing the individual is one of the challenges in designing the environment approach and behavior (Dolah, M. S., 2014). Other product design factors should be considered by different users. Open-plan system (OPS) furniture is increasingly popular in design studios, and there is a need to review the existing design criteria for OPS furniture. The workplace should suit the culture and nature of a group's work (Harrison and Dourish, 2006). The proper design criteria lead to quality products.

There is a stage in the product development process that the designer needs to validate the product to be used by the users to get feedback on how the product meets the users' needs. However, there was no standard evaluation form to validate the relevancy of that product.

In this research, the researcher used OPS furniture as the focus product design, classifying as furniture design. OPS furniture is usually used for offices, but nowadays, most universities used it as classroom furniture. Manufacturers' office furniture isn't typically made to fit the measurements of each particular user (Adu, G. et al., 2014). The idea of studio work is fundamental to practices and education in design fields such as architecture and industrial design. (Fallman, 2007). The researcher’s target location is the Faculty of Design and Architecture (FRSB), University Putra Malaysia, Serdang,

Selangor. The Industrial Design Studio has been one of the studios that have used the OPS since the 2014 renovation. The researcher is a former Industrial Design degree student at UPM, so her insights and opinions are expressed. The researcher identified that OPS used originally for office spaces, nowadays was used for the student, making a gap for the different design criteria.

In this study, the researcher will use the survey technique to determine the design criteria of OPS that satisfy the demands of the students in the Design Evaluation (DE) form, which was originally designed by the researcher. The previous researcher investigated OPS, which focuses on user satisfaction aspects.

As the environment and office culture change, the office environment's design should move along as well. A research methodology has been created to help designers identify users' environmental experiences at work and propose a process to assess users' needs and aspirations. (Dolah, 2014).

Thus, the study will develop the design guidance for the validation process to identify user feedback toward their product or furniture design.

This study is essential to clarify the importance of validation to a real user for the product development process. Furthermore, this validation will help designers develop the attributes or design criteria for new product development. In this research, the implementation of a Design Evaluation (DE) survey priorities design criteria and come out with the standard guidance to validate design called the Post-Occupancy Design Evaluation™ (PODE) form. From the researcher's observation, figure 1.1 shows the view of industrial design studio furniture arrangement.

Figure 1.1 : View of Industrial Design Studio furniture arrangement, Year 4, Faculty of Design and Architecture (FRSB), University Putra Malaysia (UPM)
(Source: Author,2019)

1.2 Problem Statement

There is a need to develop the Post-Occupancy Design Evaluation™ (PODE) standard guidance design criteria of OPS for students used. To sustain the product quality in the future, the developed priority of design criteria are used to create an evaluation form called Post-Occupancy Design Evaluation™ (PODE). The Post Occupancy Design Evaluation™ (PODE) approach is a novel approach developed by the researcher. The designer unable to define the relevance of using office furniture in classroom space because there is a difference between space classification, activity and users. This study will identify the priority of design criteria attribute given by the Expert Designer (ED) through the data collection in Chapter 4.

Faculty of Design and Architecture (FRSB), University Putra Malaysia (UPM) has several industrial design studio classrooms. From researcher's experience, the student spends most of their time in the design studio, where they stay there to finish all their assignments and projects. Besides, most students make the studio as their second hostel, as they also apply to the faculty to stay on the weekend to do their assignments and projects. Hence, this clearly shows that they spend lots of time in a studio at a university.

Observing the condition of the furniture and the scenery of the studio was used to conduct research in the studio of industrial design students.

Some damage occurs on existing OPS furniture because of students' reorganized of the furniture to their needs, the components, space, and the table's material to feel compatible with their furniture modifications. Therefore, this shows that the current furniture could not meet their needs as the furniture is for office use. Most of the criteria need to be reviewed as it used for a different activity. There was unused office furniture, which was unnecessary. As to meet the student needs, the furniture firstly needs to be evaluated. At the same time, the most crucial part is the furniture need to be assessed after it has been used for almost six years. There are questions about how the student's furniture requirements are decided. As a result of observation, 5 problems were found. The issues were as follows:

i. **The hazard of extension wire on the floor, which impedes student movement**

Figure 1.2 : Plug extension wire on the floor, Industrial Design Studio, Year 4, Faculty of Design and Architecture (FRSB), University Putra Malaysia (UPM)
(Source: Author, 2019)

Each student needs plugs to connect the laptop charger as they use the laptop for more than 4 hours in the studio. All studio only has three powerpoint built into the wall. Based on figure 1.2, they need to bring their plug extension wire to their studio as a student need to share the build-in power point with over 40 students.

ii. The uninstalled partition and table without partition

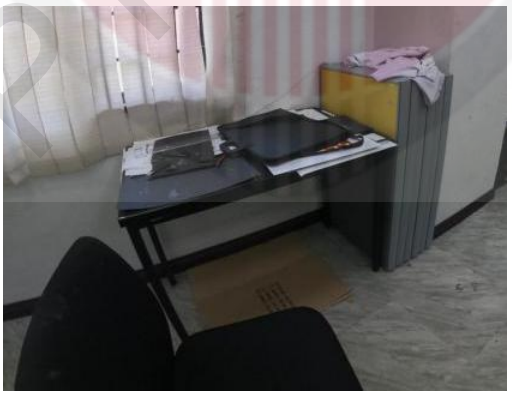

Figure 1.3 : A few uninstall partition & table without partition, Industrial Design Studio, Year 4, Faculty of Design and Architecture (FRSB), University Putra Malaysia (UPM)
(Source: Author,2019)

Figure 1.3 shows the unused partition as it uninstalls and backs up to the end of the table. The student has uninstalled the partition as they feel that the partition limit their movement and activity. This problem shows the criteria called flexibility. It will be the priority of design criteria for this study.

iii. Unorganized project and personal stuff in table and under table

Figure 1.4 : Unorganized project and personal stuff on the table and under the table, Industrial Design Studio, Year 4, Faculty of Design and Architecture (FRSB), University Putra Malaysia (UPM)
(Source: Author,2019)

Figure 1.4 shows the project stuff and student's belonging are put on the table and under the table. The property seems messy and unorganized. Things underneath the table cause one's feet to interrupt while one is seated. From the observation, there was no storage for students to store their project stuff and belonging. Storage is a crucial component of OPS furniture, thus this issue should be taken into consideration. In order to service the organized workplace, the OPS furniture for students criteria must be regarded in this case.

iv. Part of incomplete furniture without front partition

Figure 1.5 : Part of incomplete furniture without front partition, Industrial Design Studio, Year 4, Faculty of Design and Architecture (FRSB), University Putra Malaysia (UPM)
(Source: Author,2019)

Figure 1.5 shows the incomplete furniture component,which was the front partition, resulting in the student putting a note on the wall. There is no front partition for the furniture in front of the wall. The student used masking tape to paste their notes on the wall, causing the painted wall to be affected.

v. The most optimal use of tables for project storage

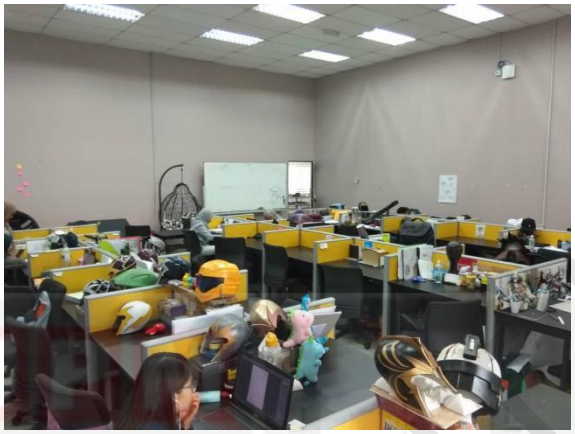

Figure 1.6 : The most optimal use of tables for project storage, Industrial Design Studio, Year 4, Faculty of Design and Architecture (FRSB), University Putra Malaysia (UPM)
(Source: Author,2019)

Figure 1.6 shows an overview of the student's table in the studio. It shows all the project stuff mainly was put on the table. It was evident, that the view appeared disorganized. It also requires that the studio should provide storage for students' project materials.

1.3 Research Question

- Main research question: What are the standard guidance priority of design criteria for open-plan system design furniture for students?
- Sub-RQ 1: What are the priority of design criteria of the Open-plan System (OPS) furniture for a student used.
- Sub-RQ 2: How to develop the Post-Occupancy Design Evaluation™ (PODE) of Open-plan System (OPS) standard guidance design criteria for a student used.

1.4 Research Objectives

- RO 1: To identify the priority of design criteria of the Open-plan System (OPS) Furniture for a student used.
- RO 2: To develop the Post-Occupancy Design Evaluation™ (PODE) of Open-plan System (OPS) furniture standard guidance design criteria for a student used.

1.5 Area of Study

Even several other institutions used the studio as their design student's classroom. It is a priority for a researcher to implement the design evaluation form in the UPM area first. In the future direction of this study will be implemented in other universities other than UPM.

- **Faculty of Design and Architecture (FRSB), University Putra Malaysia, Serdang**

Faculty of Design and Architecture (FRSB), University Putra Malaysia, Serdang is the study area selected as it more convenient for conducting the research in this area.

- **Industrial Design Studio**

FRSB has three departments which all the department has adapted studio culture. However, the Industrial Design department is the newly converted to fully Open-plan system furniture for all their studio among these three departments.It's a great opportunity for this study to choose those studios as the study area because they were only refurbished six years ago.

1.6 Significant of the study

This study has identified the need for evaluation of furniture or products' designs. Besides, this study also emphasizes the importance of design guidance for designing OPS furniture as a reference for designers in the future. Finally, the approach introduced in this study is very beneficial for every designer to test their product design in the future.

1.7 Scope and Limitation of the Study

This research was grounded theory in the Department of Industrial design UPM as a case study to develop the PODE guidance form. This study's research scope is the design criteria for OPS currently used by design students of Industrial Design Studio. Many academics have looked at the OPS, with the majority of them focused on one-to-one factors such as ergonomics, anthropometry, usefulness, or durability. However, there is a lack of research on the whole criteria of OPS. These create a limit for the researcher to gain the basic standard design criteria for OPS in Malaysia. Although there are Malaysia Standards MS1315-1 and MS1315-2 for Office Furniture, they only state the standard for storage furniture in terms of safety requirements, structural stability, and strength.

1.8 Research Framework

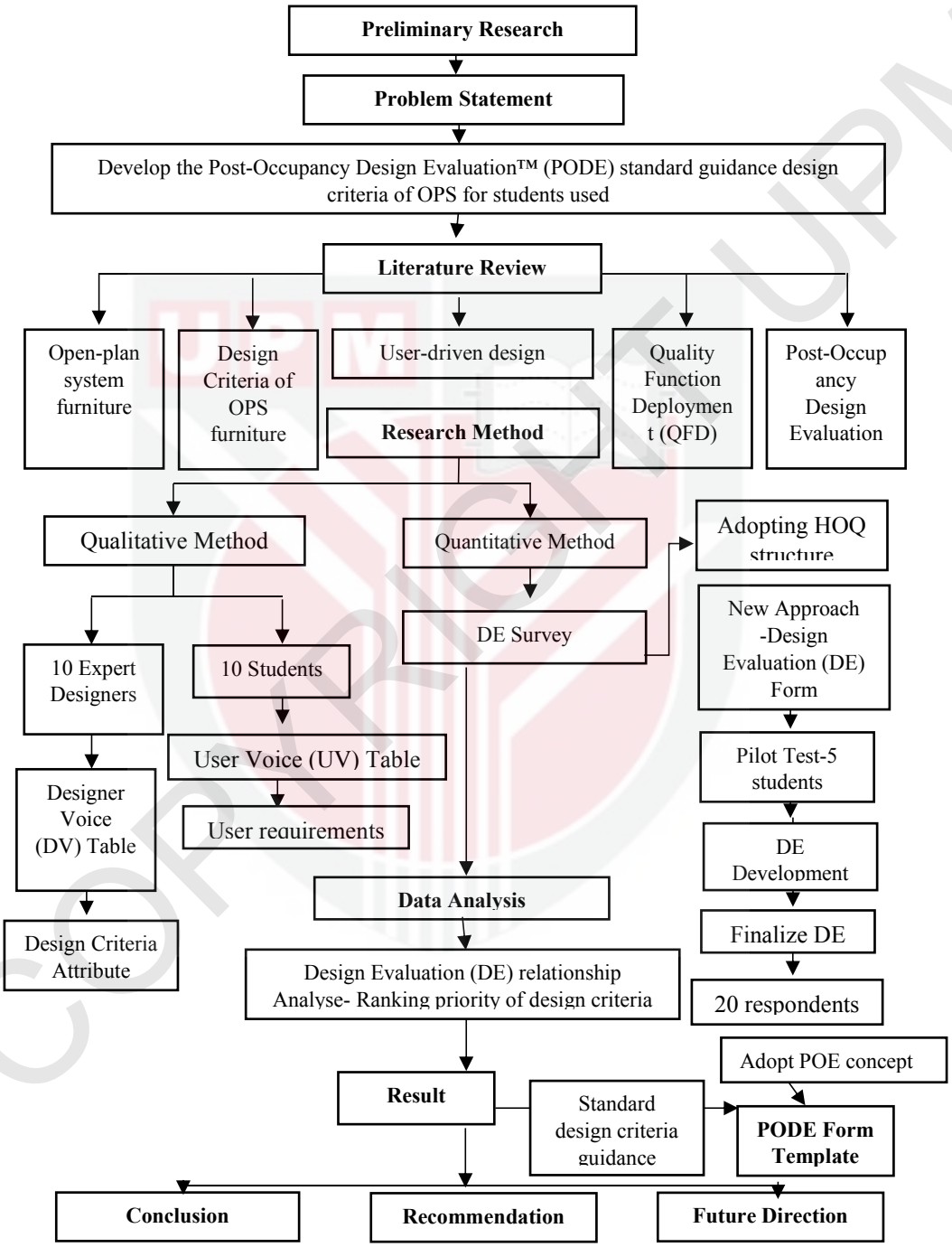

Figure 1.7 : Research framework flow chart
(Source: Author,2019)

Figure 1.7 shows, the research framework flow chart. It shows the step and processes of research ongoing to led the result. To develop the PODE™ for OPS furniture used by students, the research process is undergoing five procedures which have identified the problem to solve, looking for the source of previous research, identified the method to use, analyzed the data collection, found the result of the study and finally, the recommendation for further research.

1.9 Conclusion

The end-user is the person who has ultimately used the manufactured product. The product development involves the validation stage that designers need to hear from the customer about their product design feedback. The researcher used open-plan system furniture in this study as the focus product design known as furniture design. A quality product leads to the correct design requirements. Because the use of OPS is becoming more popular among design studios, the current OPS furniture design criteria must be reviewed. The writer is a graduate student in Industrial Design at UPM, so her insights and opinions are expressed. The researcher noticed that for the student who creates a gap for the various design requirements, the use of OPS, which was originally used for office spaces, was now used. This research is vital to explain the value of validation for product development processes for actual users. To preserve the quality of the product in the future, the critical design criteria developed will be used to create an evaluation form called Post-Occupancy Design Evaluation™ (PODE). As it is used for various purposes, most of the requirements and specifications need to be reviewed. First of all, implementing the design assessment form in the UPM region is a priority for researchers. This research will be applied in the future by universities other than UPM. Serdang, University Putra Malaysia, is the study's region chosen as more convenient for the analysis to be carried out. Design criteria for the OPS furniture currently used by design students of the Industrial Design Studio are the scope of investigation for this report. In the UPM Department of Industrial Design, this study was conducted to develop the PODE™ guidance form.

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