UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGNING A FRIENDLY CAMPUS "LEARNING ENVIRONMENT" MODEL FOR FKP STUDENTS USING PRODUCT SERVICE SYSTEM CONCEPT

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Design) (Hons.)

By

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DECLARATION

I hereby, declared this report entitled “Designing a Friendly Campus "Learning Environment" Model for FKP Students Using Product Service System Concept” is the result of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Manufacturing Engineering of UTeM as a partial fulfilment of the requirements for the degree of Bachelor of Manufacturing Engineering (Manufacturing Design) (Hons.). The member of the supervisory is as follow:

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ABSTRAK

Dalam projek ini, reka bentuk ruang kerja untuk pelajar yang terdiri daripada konsep persekitaran pembelajaran dikaji menggunakan konsep Sistem Perkhidmatan Produk. Terdapat beberapa kajian mengenai reka bentuk ruang kerja yang kebanyakannya dinyatakan dalam reka bentuk ruang kerja di dalam bilik darjah direka supaya pembelajaran yang boleh diteruskan dengan tekanan yang minimum dan keberkesanan yang maksimum. Tiada seorang pun daripada penyelidikan dibuat bagi ruang kerja di luar bilik darjah buat masa ini. Oleh itu, objektif utama kajian ini adalah untuk mencadangkan model persekitaran pembelajaran di mana pelajar boleh mengumpul, belajar, berehat, bersosial, makan, dan bekerja antara kelas. Untuk tujuan ini, soal selidik telah diedarkan untuk mengenal pasti tingkah laku pengguna dalam usaha mengumpul senarai keperluan dalam pembangunan model persekitaran pembelajaran. Juga, kes penggunaan telah dilakukan untuk mendapatkan ciri-ciri sifat berfungsi dan berkaitan model persekitaran pembelajaran. Projek ini mengfokuskan pelajar Fakulti Kejuruteraan Pembuatan (FKP) untuk menjalankan kajian dan memperlihatkan model persekitaran pembelajaran yang dipanggil "One Stop Center". Daripada 10 fungsi persekitaran pembelajaran yang dicadangkan, hanya 4 fungsi mempunyai keutamaan tertinggi: ruang untuk menggunakan komputer riba dan sambungan internet, televisyen, mesin layan diri dan satu bahagian percetakan. Model "One Stop Center" telah digambarkan dalam model 3D dan ditunjukkan kepada pelajar-pelajar Fakulti Kejuruteraan Pembuatan di mana kebanyakan daripada mereka bersetuju dengan perkhidmatan yang dicadangkan dan kemudahan seperti ruang untuk menggunakan laptop dan sambungan internet disediakan dengan sambungan rangkaian dan seksyen percetakan dengan perkhidmatan percetakan. "One Stop Centre" telah dikenal pasti sebagai penyelesaian untuk memperbaiki persekitaran

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pembelajaran di luar bilik darjah secara khusus untuk penyediaan perkhidmatan kepada pelajar FKP.

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ABSTRACT

In this project, workspace design of a learning environment for students is studied using the concept of Product Service System. There are a few researches regarding workspace design which most of them specified in the workspace design inside of the classroom designed so that learning may proceed with minimum stress and maximum effectiveness. None of the current research is made for workspace outside of the classroom. Therefore, the main objective of this study is to propose a learning environment model in which students can gather, study, relax, socialize, eat, and work between classes. For this purpose, questionnaire was distributed in identifying the behavior of user in order to generate a list of requirements in the development of the learning environment model. Also, a use case was developed to obtain the characteristics of functional and related attributes of the learning environment model. This project chooses students at Faculty of Manufacturing Engineering (FKP) to conduct the study and the learning environment model was called One Stop center. Out of 10 functions of a learning environment proposed, only 4 functions have the highest priority: a space to use laptop and internet connection, a television, a vending machine and a printing section. The One Stop Center model has been illustrated in 3D model and shown to the students at Faculty of Manufacturing Engineering in which most of them are agreed with the proposed services and facilities such as a space to use laptop and internet connection is provided with network connection and printing section with printing service. One Stop Centre has been identified as a solution to improve learning environment outside classroom specifically to the provision of services to FKP students.

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DEDICATION

Dedicated to my beloved parents, siblings, family members, my supervisors, lecturers and to my beloved friend who help me throughout the projects.

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ACKNOWLEDGEMENT

I would like to thank my supervisor, Dr. Suriati Binti Akmal for her guidance and supervision throughout the entire project. I would also like to thanks my parents and family members who have supported me during my study. And lastly, I would like to thank my beloved friend, Annasuha Binti Norizan who have helped me with the project and with my study in UTeM.

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LIST OF ABBREVATIONS, SYMBOLS AND NOMENCLATURES

FKP – Fakulti Kejuruteraan Pembuatan

PSS – Product Service System

CAD – Computer Aided Design

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CHAPTER 1
INTRODUCTION

1.1 Background

The learning environment consists of all those physical-sensory elements such as lighting, colour, sound, space, furniture, and so on that characterize the place in which a student is expected to learn. This surround should be designed so that learning may proceed with minimum stress and maximum effectiveness. Thus, it should promote sensory comfort and high auditory and visual acuity; and its dimensions and physical layout should accommodate scheduled activities, allow for people's sense of personal space, and promote desirable patterns of social interaction and communication.

Generally, the workspace is s term to enclose the working process taking place in a space and promotes the desirable patterns of social interaction and communication. The term of workspace design is inspired by a research work at MIT School of Architecture and Planning which proposed to overcome the architectural issues on the workspace and layout buildings (Seim and Broberg, 2010).

The advancement in technology has transformed the way of workspace design from physical elements toward a more integrated solution for improving the learning activities. Designers have an urgent need to add value in the physical product to promote the integrated solution. However, the integrated solution is not a solution that embeds a

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value into physical products. The challenge to the designer is thinking about creating a solution that supports the customer's activities related to the use of the product (Tan, 2007). Various approaches are proposed to create more value into a product such as customization, design for x, and ergonomics.

As a result of the growth of the telecommunication technology, today's workspace designer should consider the impact human population, specifically generation Y who are born during 1981–1999. This generations are identified as confident and technologically advanced, and they come with a sense of entitlement (Erickson, 2008). Therefore, designing a workspace for Generation Y students should address the learning spaces beyond classroom walls. Also, a workspace is a holistic system that creates work experience in which connection is an element that they value the most. For example, a flexible space that allows social-interactions in which students and faculty members can meet informally to discuss about the current news and study (Wulsin Jr., 2013).

In recent years, there has been an increasing interest in designing a flexible and smart workspace to improve the diversity in learning activities. (Ellis and Holm, 2013) promotes the integration between virtual and physical learning space. The research is done by assimilating services and support that line up to the results shaped by curriculum requirements, adequately technologically-mediated to offer personalised services and learning support to the students. The results of the study show that the relationship between the virtual learning space and the physical learning space is not straightforward, it is rather complex and is best understood from the perspective of learning by the students. (Martinez-Maldonado, et al., 2012) studied an approach for exploiting the collaboration between teachers and students by providing a tool called a multi-table top classroom system as a way to monitor a classroom activities. The work is aimed to help students to work in a group in a classroom. For this purpose, a software system is developed and it is monitored by a particular teacher that conducted the class. As a result, the multi-table top classroom is a method for a teacher to monitor a collaborative learning activities. Also,

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workspace design focus on solving communication issues to support information exchange during learning activities. There is also a study regarding a flipped or inverted CLASSROOM, a workspace design for cooperative learning and innovative teaching methods by (Strayer, 2012).

Another approach to improve the workspace design is in the view of the interaction between human and workspace environment. This study is called ergonomics. It aims to maximize the performance on human completing a task. For this purpose, there are five elements should be considered in designing an ergonomic working environment: safety, comfort, ease of use, performance or productivity and aesthetic. By integrating this ergonomic aspect into the workspace design, the design, produced by it could be better in term of its functionality and also its visualization. With a good safety and comfort aspect of the design of the workspace, the users would feel much at ease which could leave them having a feeling like staying inside their own home. Ease of use is by ensuring the design produce will be use friendly whereas, every service provided need to be easier for them to use. Performance or productivity on the workspace design could help increase the user which is the students to be much more efficient for them to do their respective works. Lastly, the aesthetic aspect of the workspace design. With aesthetic, it could leave a good impression to the user because of the visual design of the workspace design. This elements is the current approach that are commonly used to increase the productivity.

The research to date has tended to focus on workspace design for improving the leaning activities, but none of the existing approach provide the method to supports the customer's activities related to the use of the physical workspace design. In this project, Product Service System concept is used to support new ways to integrate the physical space and services that is based on student activity that has high intense use of information and communication technology.

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1.2 Problem Statement

Product design teams always run into barriers when they try to add value to the design within the limit of their existing perceived product system (Davis, et al., 2010). Therefore, they require a design approach that enable them to think outside the box and set the phase of innovation of physical product. One of the approach is to add service into a physical product. However, is not simply adding service to physical product. Service in a broad application of adding value can be used to customize, dematerialize, or proliferate product offerings. In combination with physical product, namely product-service systems (PSS) (UNEP, 2001).

Product-Service System (PSS) is an innovation strategy that produces an added value through integration of product and service by adopting the customer-centred activities (Baines, et al., 2007), (Marques, et al., 2013), (Muto, et al., 2015). The systems focus on fulfilling customer's needs such as I need a printed paper rather than on product purchases i.e. I need a printing products to print my paper. Value creation during the product and service innovation can be achieved by knowing how the customer recognizes value (Marques, et al., 2013). Therefore, the role of a designer is challenged to move into a paradigm shift that is required designer to synthesising different concurrent perspectives such as culture, society needs with respect to certain technological.

The designer in PSS has broadened area of work from product focus to human-centred design and next to social-centred design. Designer needs to think holistically at a system level in which the cultural and societal values, user and technology has the same relevance (Morelli, 2002). This requires designer to have the integration of distinctive knowledge domain. Also, there is a need for designer to be prepared for life-long interaction with customers (Diehl and Christiaans, 2015). Subsequently, it requires designer to have depth understanding and clear definition on value proposition for customers in order to have long-lasting relationship with them.

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In order to support the design for PSS value proposition definition, some authors suggest value proposition is the intangible value perceived by customer over a long period of time (Panarotto, et al., 2012), (Patalaa, et al., 2013), (Diehl and Christiaans, 2015). The intangible value drivers are (Panarotto, et al., 2012): (1) knowledge of customer related to company, and its offering, (2) emotions of customer feel on uniqueness of a product and (3) customer experience of satisfaction who are feel being connected to the product. There is a lack of research on assessing the intangible value elements for workspace offerings in early PSS design.

Several tools has been developed to identify the intangible value such as persona and blueprint. Service blueprinting involves the description of all the activities for designing and managing services, including schedule, project plans, detailed representations and design plans, or service platforms. Blueprinting is often supported by methodologies that elicit functional elements of services, as well as their qualitative/implicit characteristics, including TQM techniques, such as Quality Function Deployment (Ramaswamy, 1996), Just in Time, and capacity planning (Hollins, 2006), or IDEF0 (Morelli, 2006).

Personas are hypothetical archetypes of potential customers that aim at representing them throughout the design process and guide the development of a product or service. Personas are not real people or average users, but user models described in details, that have the key attributes of the social group they represent. They comprise not only demographic characteristics, but also their needs, values, lifestyle, culture and personal background. While service blueprints are a customer-focused process for visualizing the factors necessary to produce excellent service, the excellent service will be performed, and creating optimal experiences for customers.

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The learning environment model would need few thing to make it viable for the users. It is as listed below:-

1. The services requirements that can best described the physical structure of learning environment model / how intangible values are perceived in PSS context.
2. The characteristics of the functional requirements of the learning environment model.

1.3 Objectives

The main objective of this project is to propose a learning environment model in which students can gather, study, relax, socialize, eat, and work between classes. In pursuit the main objective, the following sub-objectives should be achieved:

1. To identify the behaviour of user to generate a list of requirements in the development of the learning environment model.
2. To identify the characteristics of functional and non-functional requirements and their related attributes of the learning environment model.

1.4 Scope of Study

In this project, the learning environment model is called One Stop Centre (OSC). The proposed model is a PSS-based design model that is aiming to give a comfortable area by fulfilling the customer intangible value in a physical workspace design. To ease the authors of this report, the focus of this limited to students at the Faculty of Manufacturing Engineering, Universiti Teknikal Malaysia Melaka.

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In this study, a method which is the product service system is used to obtain the best design which suits the student needs and requirements. Survey questionnaire is a method which is used to gain the needs and requirement from the students. Other than that, a use case method is used by interviewing a few students of the Faculty of Manufacturing Engineering. With the help of the use case, the difference between a functional requirement and a non-functional requirement to be used in the One Stop Centre design can be obtained by it.

The design of the one stop center is not based towards the learning process, but it is based on the environmental of the workspace design of the one stop center which will then affect the learning process.

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CHAPTER 2
LITERATURE REVIEW

2.1 Workspace Design

The meaning of a workspace is that it is a space of which user need to do task. A workspace would consist of users, equipment, tools and the working environment. The workspace design is use to improve the relation between human and machines and also the environment. All of this could help to increase the efficiency and production of a procedure. There are no exact way to measure the level of successfulness of a design. Nevertheless, there are general guidelines which can be used before the design of the workspace. This could help in creating design with good design (Yusof, 2007).

To design a layout for a workstation, meeting the principle of the ergonomic is not an easy job. This is because, many aspect need to be consider such as the number of interacting and the element variable. And also to meet the number of requirement, some of the aspect could oppose. Actually, there is interdependence between the workplace mechanisms, the user, their task needs, the environment, the characteristics of the building and performance of the work (Figure 2.1) (Margaritis and Marmaras, 2007).

The design of good workspace when an employee can change position to relieve stress and pressure posture while still carrying out their duties in an efficient and simple

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