

Smart Reading Chair Design by using Kansei Engineering

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Abstract: Reading is a fun activity that many people material. A reading chair is an important furniture to have. engage in, whether for an exam, leisure, or to gain There are several reasons why someone should own a knowledge on a specific subject. Because reading usually reading chair instead of sitting on the floor, standing, or takes a long time, the reader should be as comfortable as lying down on mats while reading. A common problem possible while reading. A reading chair is an essential piece faced by avid readers and people who sit for long periods of of furniture to have. As per our research findings, there are time is backache, which is strongly related to their posture numerous reasons why someone should have a reading while sitting. A good reading chair will protect the reader's chair in his or her reading room rather than sitting in neck and reduce the strain on the neck to prevent aches after alternative ways such as standing or lying down on mats. prolonged sitting. In today's world, it is common for people to The methodology used is document analysis and suffer from low back pain caused by sitting. In adults, 60% questionnaires with 192 respondents. Furthermore, the experience low back pain because of sitting. A lower back research indicates that backache is a common problem for injury is most commonly accompanied by pain in the avid readers and people who sit for long periods and is buttocks, thighs, or legs. This pain is exacerbated by flexion and sitting, which aggravates the condition. (Delitto et al., 2012). Kansei Engineering is a method for translating consumer Kansei into product design elements. According to this study, Kansei engineering translates customers' psychological needs and feelings into the design of products and services. This technique will allow designers and manufacturers to incorporate Kansei into product design to gain a competitive advantage. Our research paper proposes a smart reading chair design based on Kansei Engineering's fundamental principles and methods, which provided scientific guidance for designing a chair to meet consumers' emotional needs.

Keywords: Kansei Engineering, Kansei word, Smart reading chair, Product design

1. Introduction

Reading is an age-long habit of most people and whether reading for an exam, for leisure or simply reading to gain knowledge on a particular subject, reading is a useful and fun activity that many people engage in. According to the online survey conducted by Gfk with over 22,000 consumers aged 15 or older across 17 countries, it shows that 30% of the international online population read books every day or most days. Spain and the UK each account for 32%, followed by China with 36%. As a result, if daily readers and those with a weekly reading habit are added, the international total rises to 59%, with China leading the pack

with 70%, followed by Russia with 59% and Spain with 57% (Majority of internet users read books either daily or at least once a week, 2022).

Because reading usually takes a long time, the reader must be as comfortable as possible when enjoying the reading

It has been reported in numerous studies that the design of furniture plays a significant role in determining the pressure at the seat pan interface when considering posture and chair design. According to this study, differences in chair design affect pressure at the seat pan/thigh interface by affecting trunk-thigh angle and the use of armrests (Vos et al., 2006).

The objective of the study is to design a smart reading chair while meeting the user requirements by applying the Kansei Engineering (KE) approach considering the human feelings or emotions of users. The Kansei Engineering strategy was founded 35 years ago at Hiroshima University, and it converts customer psychological feelings into design elements (Kalansooriya, 2016). Kansei Engineering develops products based on consumer demands and feelings. There are four points concerning Kansei engineering;

- i. In terms of ergonomics and psychological evaluation, how to grasp the consumer's feeling (Kansei) about the product
- ii. how to identify the design characteristics of the product from the consumers feeling
- iii. how to build Kansei Engineering system as an ergonomic technology
- iv. how to adjust the product design to the current societal change in people's preferences.

Section 2 of this paper deals with the related works on smart chair designing, that identify the Kansei words for the proposed system. Section 3 presents the methodology of the proposed smart chair that involves the Kansei Engineering principles in its approach. Section 4 presents the results of

the conducted study and section 5 provides the discussion and conclusion section of this paper.

2. Methodology

The study's methodology primarily focuses on the Kansei design principles. In order to create a product that will make people happy and satisfied, Kansei Technical (KE) integrates the engineering discipline with human feelings and emotions (Kansei term).

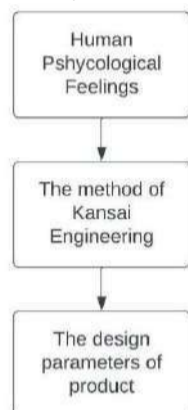


Figure 1. Diagram of Kansei Engineering Method

A chair design workflow using forward quantitative inference is developed, as well as a chair modeling design framework based on Kansei engineering. It is appropriate for the conceptual design stage of chairs and can be used in conjunction with examples of modern chairs to have a thorough understanding of chair modeling designs based on Kansei engineering. (Yong-Jun, Zhong-Feng and Rui-Lin, 2014).

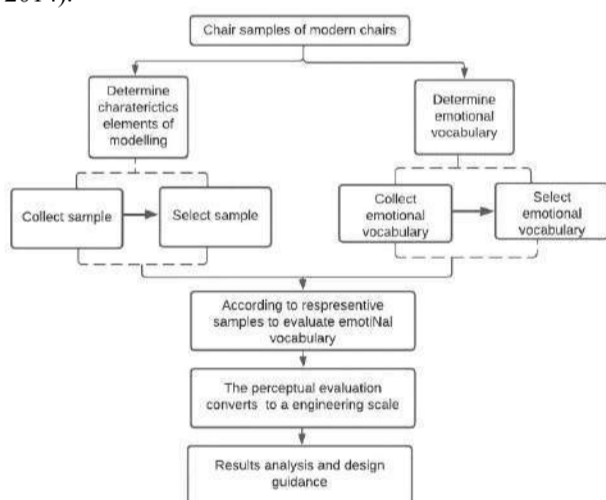


Figure 2. Framework of Chair shaping design based on Kansei engineering

The modeling is broken down into a number of independent parts, such as the backrest, seat, armrest, leg, and so on, using the structure of the chair as a starting point. Additionally, each item is broken into distinct categories based on defining characteristics. For example, the backrest item was separated into linear, curved, line and plane, plane,

and curved surfaces categories. (Soewardi and Dindadhika, 2018).

The majority of the samples of modern design chairs are gathered from furniture stores, periodicals, the internet, books, and other media. In the process of gathering emotional vocabulary, one hand was primarily used to locate pertinent literature on modern-style chairs in domestic and international sources; the other hand was used to compile emotional vocabulary specific to modern-style chairs from sources such as furniture-related books, websites, magazines etc.

Then, using an expert method, it preliminary picked, edited, and classed the emotional image vocabulary. Senior furniture designers and professional furniture experts are the professionals, allowing for the features of the modeling of the contemporary chairs. As a result, it uses the chair's disassembly to identify some preliminary characteristic elements. (Yong-Jun, Zhong-Feng and Rui-Lin, 2014).

3. Experimenral Design

A psychological term known as "kansei" (Jindo, Hirasago and Nagamachi, 1995) refers to the integration of customers' sensory perceptions (sight, hearing, smell, touching, and so on) and cognition induced by the size, color, functionality, pricing, and other qualities of the object. Physical product design, online interface design, and operational efficiencies (Hansopaheluwakan et al., 2020) are a few design fields where this is applicable.

This strategy's key concepts revolve around identifying product attributes and establishing a connection between them and design components. This strategy is built around three key concepts: thoroughly understanding the Kansei customer; reflecting on and implementing Kansei knowledge into a product design; and creating new framework and structure for the Kansei-oriented design. (Hihara, 2009).

A. Ergonomic Survey Study Chair with Anthropometric Approach and Quality Function Deployment

Every client wants to feel comfortable, thus any designer who focuses on maintaining a high standard for customers has a serious challenge. Customers are often willing to pay more for an item if it genuinely meets their needs if the price is higher. It is anticipated that this design will act as a blueprint for pleasant, portable, and widely available folding study seats (Luthfini Lubis and Vivi Putri, 2020). The process of developing client wishes is derived from the previous stage's House of Quality (HOQ) matrix; via this process, it will be known how the customer requires for a product, therefore it's something that is a useful input for

concept development (Felekoglu and Oz Mehmet Tasan, 2020).

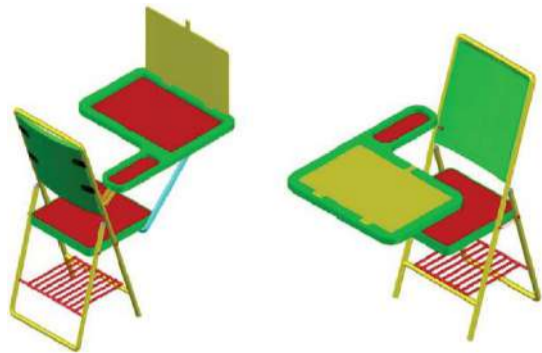


Figure 3. An anthropometrically-based ergonomic study chair with quality function deployment (QFD)

Ergonomics is a structured field of research that combines information about human nature, propensities, and restrictions to design practical systems that enable people to live and work in ways that are efficient, secure, and enjoyable while also achieving the desired goals. In general, ergonomic studies have two primary goals:

1) To improve people's dependability, performance, and efficiency of work by enhance the effectiveness of interaction between people and other work atmosphere components while lowering the level of human mistakes; and

2) To improve people's dependability, performance, and efficiency of work by enhance the effectiveness of interaction between people and other work atmosphere components while lowering the level of human mistakes; and Concept selection is the technique of assessing concepts by paying attention to client requirements and other considerations, comparing the relative strengths and weaknesses of the concept, and selecting one or more concepts for further inquiry, experimentation, and execution (Bonilla et al., 2008).



Figure 4. Ergonomic study chair with table for all ages

In order to create this product, the anthropometric measurements of the child's body are first obtained, and the percentile values for each dimension are then computed. Later, a guide called The House of Quality was created to help consumers identify product attributes. The researcher

constructs the physical three-dimensional form of the product after all the data is ready.

Seven crucial factors, including product functioning, safety, life cycle, material, aesthetics, ergonomics (comfort), and economics, are proved to have an impact on consumers' propensity to purchase products. Planning for the level of consumer interest in and satisfaction with product design is therefore made easier.

A. Design of Geriatric Reading Chair Using Quality Function Deployment (QFD) Approach to Minimize Musculoskeletal Disorders

The reading chairs that are presently on the market will be contrasted with the geriatric chair that was constructed using the QFD approach. The picture depicts a competitive reading chair design that is already available and is frequently used by people to read at home and unwind (Figure 5). The HOQ matrix comparisons reveal that the reading chair design that will be manufactured outperforms



Figure 5. Existing chairs on market using quality approach

competitors' reading chairs in a number of aspects, including feature innovation that is better suited for user demands, comfort level, and reading chair design that will be modified to increase comfort.

The results of the design of reading chairs for the elderly are shown in Figures 4 and 5, with dimensions based on the results of anthropometric measurements and modified with the researcher's consent. The design of the rejuvenation reading chair includes the aspects that are described below.

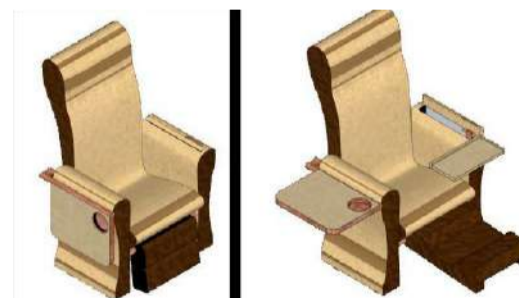


Figure 6. The design of the reading chair for the elderly

i. Rear of the chair:

The back of the reading chair for seniors is designed to fit their anthropometry while they are sitting upright and straight. This is done to make sure that older persons reading

recommended to sit upright with your back straight. Leaning forward might result in neck and back pain, which can make it challenging to concentrate. Additionally, make sure the spine is positioned upright. Sit upright in a chair and press your cartilage firmly on the chair's back to reach this position. Because it hurts, avoid leaning over.

ii. Footstep:

Reading chairs include steps because it is recommended to maintain the legs straight when reading a book, with the thighs parallel to the floor and the lower legs perpendicular to it (Mukhtar, 2019). Footprints on the frame of the chair support the elderly's feet when seated in a reading chair. The angle of the footstep may be adjusted to suit the user's preferences and comfort.

iii. Have a drinking establishment:

In order to make it simpler for seniors to store their drinks while reading books, the reading chair has a compartment for food and drinks that is connected to the chair. Everyone needs to drink water, but it's especially important for the elderly since they are more likely to get dehydrated (Yōji Akao, Mazur and King, 1990).

4. Results

A. Result of Survey

8 Kansei phrases were identified that reflected client voices based on a preliminary poll that was conducted. It was put to the test using the 5-percent fault tolerance listed in table below.

Table 1. Kansei words – Breakdown

Selected Kansei Words	Description
Comfortable	Provide a cozy layout.
Innovative design	Provides comfort when using distinct chair designs.
Durable	The most recent chair model is long-lasting.
Adjustable	Users can choose a low-height seat to make themselves comfortable.
Affordable prices	The price that the client can afford.
Interesting colors	The user may indulge their enthusiasm thanks to the chair's appealing hue.
Safe	Chairs constructed of a sturdy and secure material
Easy to move	The layout of the most recent design makes it simple to move about.

B. Result of Mapping Process for Design

Table 2. Comfortable Mapping Concept

Kansei Word	Concept	Design Specification

Comfortable	Comfortable cushion	
	Not storing heat	Material: Foam
	Not smelly	Material: Polyester
	Appropriate shape	Interior of a square with a curve
	Comfortable backrest	
	Backrest position	Position – 90° – 100°
	Backrest shape	Full back cover
	Comfortable writing table	
	Table shape	Rectangle
	Armrests exist	Material: Poly Urethane
	Armrest shape	Rectangle
	Material for table	Material: Wood

Table 3. Kansei Word of Comfortable Design in Part





Design Specification	Design explanation
	Chair Cushion
	Backrest
	A cozy writing surface
	Arm- rest

Table 4. Innovative Mapping Concept

Kansei Word	Concept	Design Specification

Innovative	Innovative design	Backrest to table: 27 cm
	Storage rack exist	
	Drink bottle rack exist	
	Backpack holders exist	Fishing hook shape

Table 5. Kansei Word of Comfortable Design in Part




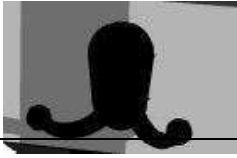
Design Specification	Design explanation
	Entry and exit capabilities
	Storage rack
	Bottle rack
	Backpack holder

Table 6. Durability Mapping Concept

Kansei Word	Concept	Design Specification
Durability	Padding for the backrest and cushions is of high quality.	Material: Foam
	Backrest and cushion pads layers made from quality material	Material: Coldore
	Made from high-quality material are the backrest and cushion's exterior.	Material: Polyester

Table 7. Adjustable Mapping Concept

Kansei Word	Concept	Design Specification
Adjustable	Table easy to fold	then fold sideways
	Height in relation to body size	Popliteal height dimension
	Type setting	Folded up

Table 8. Affordable Mapping Concept

Kansei Word	Concept	Design Specification
Affordable price	Chair with affordable price	Rs. 5,000.00

Table 9. Attractive Color Mapping Concept

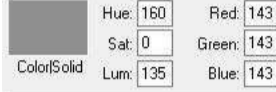

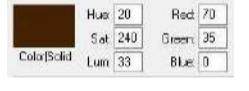
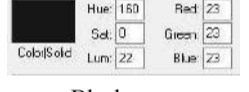
Kansei Word	Concept	Design Specification
Attractive colors	Chair with appealing colors	 <p>Gray</p>
		 <p>Blue</p>
		 <p>Brown</p>
		 <p>Black</p>



Table 10. Secure Mapping Concept

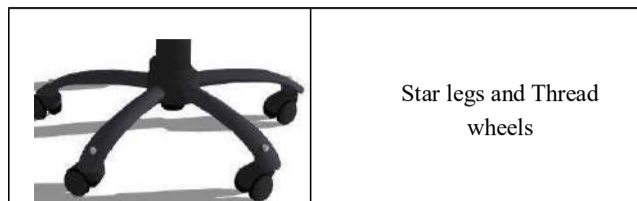
Kansei Word	Sub Concept	Design Specification
Secure	Secure Frame shape	There is a hole in the center of the circle.
	Strong Materials used	Iron

Table 11. Easy to move Mapping Concept

Kansei Word	Concept	Design Specification
Easy to move	The chair can move in a lot of area.	Hydraulic mechanical butterfly star legs and thread wheels are used in chairs.

Table 12. Kansei Word of Easy to move Design in Part

Design Specification	Design explanation
	Hydraulic shaft
	Mechanical butterfly



C. Designing the chair virtually

The next stage is to virtually create the reading chair, as the general design is shown in figure below:

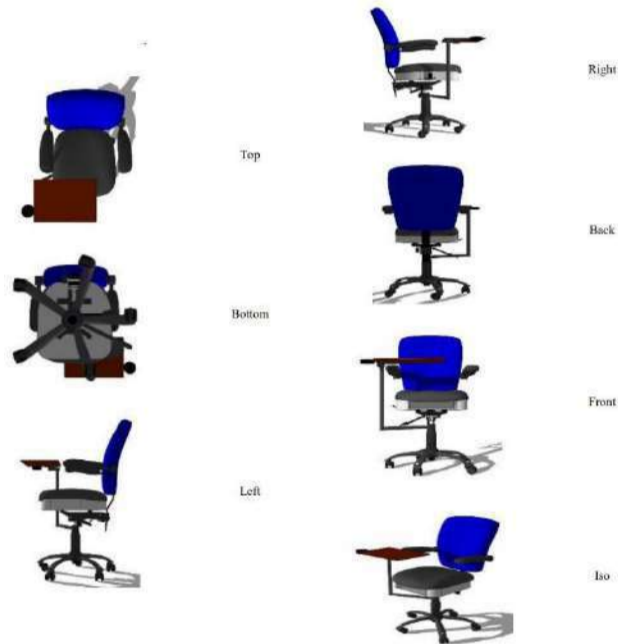


Figure 7. Virtual Concept Design

5. Discussion & Conclusion

In the process of product design, Kansei engineering is developed as a visual support technology for making sense of personal imagery and becoming consumer-oriented and in recent years, it has adapted to market development requirements.

The goal of this research was to improve knowledge of the fundamental ideas and procedures of Kansei Engineering. As a result of this study, engineers will be able to consider the emotional characteristics of reading chairs.

As a result of this research, we have found the following results:

1. Among the Kansei words that users require in college, chairs are comfort, innovation, durability, adjustability, affordable prices, attractive colors, and safety.
2. There is a 5% probability that the developed reading chair design will satisfy user requirements.
3. The following are the requirements for comfortable reading seats.
 - a. With design specifications of 52 cm by 43 cm by 6 cm, the cushions should provide a good level of comfort.
 - b. For the ability to not store heat, the material is foam, and to avoid odors, polyester is used.
 - c. Design specifications for a comfortable backrest are 65 cm long, 50 cm wide, and 3.5 cm in height.

- Writing table constructed of wood with a brown finish that is 40 cm length, 25 cm broad, and 2 cm high.
- The armrest measures 25 cm in length, 5 cm in width, and 2 cm in height. The gray armrest is made of polyurethane.
- The backpack holder is 4cm in length and 2cm in width.
- The following are the design parameters for strength: durable cushions are made of foam, and the outer layers are made of polyester.
- The adjustable design requirements are that the table is simple to change position, therefore the design standard is to fold up then fold sideways.
- The design parameter of the frame is a cylinder with a hole in the middle; the material is iron.
- For simple movement, the design parameters are as follows: hydraulic design standards for small shaft diameters of 2 cm and large shaft diameters of 3 cm. The metal is chrome, and the form is a tube.

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