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Users Satisfaction Attributes Analysis Towards Betterment of Classroom Furniture Design for Bangladeshi University Students

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Abstract

This study examined student perceptions of classroom furniture design for the purposes of raising satisfaction levels and durability. This study incorporated the Kano model to analyze student needs and satisfactions for the purpose of enhancing learning environment through identifying ways to improve student satisfaction. Proposed durable classroom furniture designs were identified according to student needs thereby enhancing the satisfaction level. The forces field analysis outcome suggested pursuit of the new furniture design.

Keywords: Kano model, Student's needs & satisfaction, Design, Classroom furniture, Durability

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Abstract

This study examined student perceptions of classroom furniture design for the purposes of raising satisfaction levels and durability. This study incorporated the Kano model to analyze student needs and satisfactions for the purpose of enhancing learning environment through identifying ways to improve student satisfaction. Proposed durable classroom furniture designs were identified according to student needs thereby enhancing the satisfaction level. The forces field analysis outcome suggested pursuit of the new furniture design.

Keywords: Kano model, Student's needs & satisfaction, Design, Classroom furniture, Durability

1. Introduction

Main goal of this paper is to validate Kano model taking help of furniture specifications of Bangladeshi university classroom to facilitate conceiving new design. Customer satisfaction is termed as a one-dimensional interpretation of some product or service. Although some product developers may believe that adding more features to a product may improve quality, such is not always the case. Disagreements exist between many experts that individual product features may not always generate higher customer satisfaction (Grigoroudis & Siskos, 2009).

The domain of human factors addresses aspects of furniture design. When attempting to generate some amount of satisfaction, human users must be considered during design processes (Nussbaumer, 2018). When crafting workspaces, designs may contribute to improved concentration, lesser interruptions, and facilitate interaction with others (McCue, 1990). One type of workspace product that permeates higher education settings is the combination of chair's and desk's that populate classrooms. Kano model is a great technique to identify the ideal attributes in the time of classroom furniture design for student's easy satisfaction. Kano model helps to capture all essential nonlinear relationship between classroom furniture's performance and student's performance.

Mostly, such items involve some form of functional requirements, and involve some consideration of user attributes within their designs. For instance, chair designs incorporate some aspects and requirements for backrests, footrests (for smaller individuals), lumbar support, tilt, and ability to adjust for height level (Lehto & Buck, 2007). Additional chair considerations include human posture and muscular activities (Karwowski & Salvendy, 2011). Desks may either have static or dynamic heights. They also should not topple when loaded, and should remain stable when overloaded drawers are opened (Salvendy, 2012).

Such considerations of human factors invoke notions of quality. Generally, human perceptions of quality may be subjective with respect to individual experiences (Van Laack, 2014). Although quality may be subjective, it may be judged numerically with respect to some forms of established metrics (Zuse, 2013).

The Kano model explains is useful for explaining relationships between customer satisfaction attributes and degrees of achievement levels of quality with respect to two-dimensional variables (Sawyer, Paech, & Heymans, 2007). More precisely, Kano model is a method of assessing quality quantitatively with respect to characteristics of customer satisfaction involving specific attributes

of quality. The attributes of quality classified in three fashions: attractive quality, must-be quality, and one-dimensional quality.

Consistently, the Kano model incorporates a perception of basic quality in which customers assume that appropriate levels of performance are satisfied at some point. It also accommodates the notion of spoken performance in which customer satisfaction is achieved when satisfaction exceeds some expressed level of service (Antony & Preece, 2002).

The Kano model also has an excitement attribute in which customers receive something they did not know they desired, and such provision generates excessive satisfaction levels. Given these notions, through the use of the Kano model, this case study examined the needs and customer satisfaction levels of Bangladeshi university students regarding classroom furniture. Classroom furniture facilitates a comfortable learning environment for students and enhances learning. Classroom furnishings, such as tables and chairs, must have strong durability and satisfy student needs (Bartlett, 2015). When crafting and designing classroom furniture, great attentiveness to ergonomic characteristics should occur (Yamamoto, et al., 2015).

Based upon the discussions, among modern class environments, furniture may incorporate both quality and ergonomic characteristics. Given these notions, this study incorporated the Kano model as a means of identifying metrics for enhancing student satisfaction with respect to the design of classroom furniture.

The Kano model illustrates the need for a product to ensure high customer satisfaction. It also evaluates product characteristics for accelerated customer satisfaction. Using a case study approach and the Kano approach as an assessment paradigm, this article considered the case of a Bangladeshi higher education institution whose aging furniture lacked the expected quality characteristics of modern classroom furniture design.

2. Review of Literature

The design of durable furniture has gained attention progressively over the past 20 years in Bangladesh. It was used for designing large amounts of school classroom furniture, workstation furniture, public places furniture, military furniture, and so on. In short, much attentiveness is directed toward generating quality and designing durable furniture with respect to satisfying human needs and satisfaction.

Lee et al., (2009) examined overall customer satisfaction associated with medical equipment in Taiwan. They integrated Kano model and exit-voice theory to achieve enhanced levels of patient satisfaction. Their research revealed that customer complaints directly affect customer loyalty. Wang and Ji (2010) understood customer needs through quantitative analysis of Kano's model. They used Kano model for identifying S_CR relationship functions to illustrate the impact of different customer requirements on customer satisfaction. Here, S-CR relationship means connection of services with customer requirements.

Högström, et al., (2010) examined the differences across various quality dimensions for satisfying customers highly via use of the Kano model. Initially, they examined physical service environments with respect to managerial focus. Mikulić and Prebežac (2011) reviewed the most commonly used approaches for classifying quality according to the Kano model. They evaluated five approaches in terms of their validities and reliabilities for categorizing attributes. Fiver approaches are flight offer, ticket purchase experience, flight experience, price and on-time performance.

They also indicated that a penalty reward contrast analysis approach was beneficial for examining the impact of product attributes with respect to overall product satisfaction, but its applicability to the classification of Kano attributes was questionable. Because, Kano questionnaire and the direct classification method are the only method capable of classifying Kano attributes in product design stage.

Lin and Chan (2011) enhanced service quality improvement strategies by integrating Kano's model with an importance performance analysis with respect to resource limitations. This situation importance-performance analysis and Kano's model are two important decision making techniques for improving customer satisfaction.

Gandolfo and Federica (2013) applied Kano's model to Sicilian hotels to examine customer satisfaction in the hospitality industry. Gandolfo and Federica (2013) adopted Kano model to explore the relevant drivers of satisfaction of hotel guests in Sicily, Italy. Määttänen et al., (2014) applied the Kano model to analyze the types of green attributes tenants value in their office buildings. The study showed that environmental efficiency increased satisfaction levels with facility management and services.

Bandyopadhyay (2015) classified service quality attributes using Kano's two-way quality model for the Indian banking sector. Basically, he studies incorporated a perspective of instrumentality with respect to customer satisfaction. The findings were useful among marketers when prioritizing improvements of service quality elements and/or dimensions with respect to customer satisfaction.

Gustavsson et al. (2016) applied the Kano model in healthcare improvements for identifying wide range of patient needs. Basically, he used customer needs (obtained from patients, relatives, and healthcare professionals) to identify a greater range of patient needs.

Arash and Sajad (2017) used the Kano model and Kano map to examine a case of hospital service regarding customer requirements classification. With respect to examining 18 inquiries, he classified patient's requirements to show that most of the requirements were deemed as normal requirements. Kumar and Routry (2017), using the Kano model, analyzed supplier preferences for manufacturing and performance value analysis.

Huang and Tsai (2017) applied Kano's model to the Internet marketing of agricultural products in Taiwan. The study he examined quality attributes improvements for increasing customer satisfaction and reducing customer dissatisfaction.

Velikova, et al., (2017), using the Kano, examined wine festival satisfaction drivers. The study surveyed 250 attendees from a wine festival in the United States of America. The study showed that satisfaction drivers varied according to the attributes of both the festival and the attendees.

Parvez et al., (2018) designed ergonomically fit classroom furniture for university students of Bangladesh. He accumulated anthropometric measurements of 300 students, calculated the resulting mismatch, and designed new furniture for the student population.

3. Fundamental Concepts of the Kano Model

Kano developed the Kano model in 1984. The Kano model involves considerations of customer requirements. There are three major types of requirements that influence customer satisfaction: one dimensional or normal, expected or must-be requirements, and attractive or exciting requirements. Given these notions, the Kano model attempts to establish relationships and connections with the requirements fulfilled by products with respect to customer satisfaction attributes. Figure 1 shows the Kano model diagram.

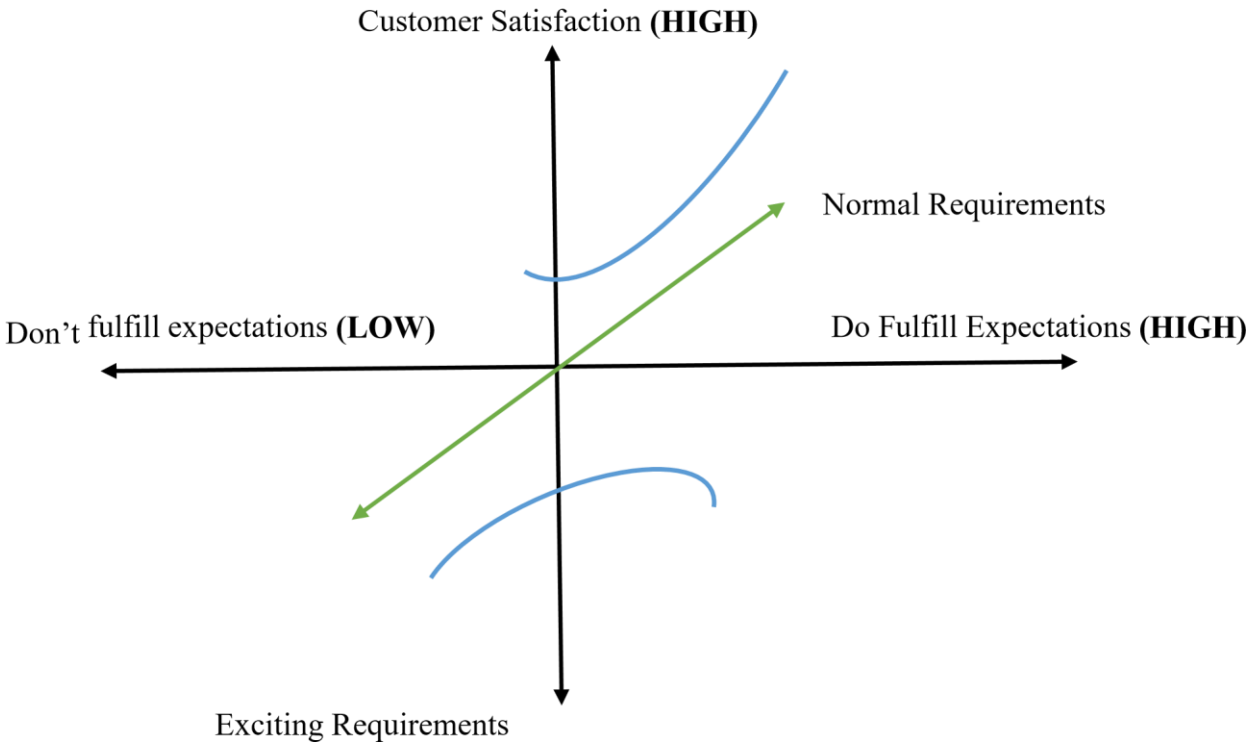

Figure 1: Kano model diagram (Kano et al. 1984)

Requirements are a mainstay of the Kano model. Within the model, normal requirements are very crucial requirements for a product or service. Conceptually, normal requirements reflect an inquiry asking, 'What do customers generally want in a product?'

Expected requirements are requirements that the customer forgot to mention until corporate implementation occurs. Examples include camera features in mobile devices. Exciting requirements reflect requirements that involve much difficulty with respect to their identification. An example would be a free Bluetooth mouse included with a laptop.

4. Case Scenario

Bangladeshi student's poor satisfaction level with classroom settings was the main reason for this study. Poor satisfaction levels arose for various reasons, such as lack of quality teacher, sound systems, lack of seats, and so forth. Therefore, the uncomfortability of classroom furniture (chair and table) was the main catalyst for a poor learning environment which contributed toward a poor satisfaction level among classroom students.

At the initial stage of investigation, we found that classroom furniture (chairs and tables) was deemed uncomfortable. By talking with students from different universities, it was determined that furniture design had not considered comfortability. The chair design had no hand rest, footrest, or good lumbar support. The table design was immovable, and lacked drawers, pen holders, foot rests, or storage spaces. It was assumed that rectifying these issues would resolve and improve low levels of student satisfaction. Therefore, this study examined methods of improving customer satisfaction.

5. Methodology

The methodology represented a case study approach for examining facets of whether students deemed desks and chairs to be satisfactory at a Bangladeshi higher education institution. The host institution was Jessore University of Science and Technology. Data were collected via a survey approach to identify problems and offer potential solutions. A total of 61 students (Male 32 and Female 29) participated in this survey. The student size comprising the population was 72. Using a 95% confidence level and a 5% error margin, the minimum sample size of 61 was necessary to ensure representativeness of the population within the sample. The sample was a random sample drawn from the population. The sample was required to know about the current satisfaction level of the students for classroom furniture design for further improvement.

The primary limitation of this study involved its examination of a solitary, Bangladeshi institution of higher education. Thus, its outcomes may be inappropriate for any other higher education institution. Regardless, this case study represented a starting point for spawning additional investigations of higher education furniture design.

Ultimately, Table provides spaces for studying in the classroom. They also provide a place for storing baggage. Chairs provide high comfort levels for users. The Kano model was applied to examine which criteria had the greater influence on customer satisfaction. Force field analysis was used to examine validity for the model with respect to conducting change.

5.1 Kano Model Study

Step 1: Customer survey
The target students were surveyed with a pair of questionnaires that contained both functional and dysfunctional questions. Functional questions exhibited positive attributes and dysfunctional questions exhibited negative attributes. Functional questions were asked in a positive manner whereas dysfunctional questions were asked in a negative manner. The participants were asked to choose from among five possible response choices. In the case of a multifunctional table and chair, a total of 11 questions were asked among 61 university students. Similar to a Likert scale in which respondents select the response that best matches their opinion, respondents selected responses from the categories of: Like, Must Be, Neutral, Live With, Dislike.

An example of the questions is presented below:
Functional question: “How would you feel if table had footrest?”

Alternatives: I like it / It must be that way / I’m neutral / I can live with it / I dislike it

Dysfunctional question: “How would you feel if table didn’t have footrest?”

Alternatives: I like it / Must be that way / I’m neutral / I can live with it / I dislike it

Figure 2 represents the total Customer Survey questions.

Customer Survey for Multifunctional Table & Chair Using Kano Model

Customer: sudipta kumar Dey
Address: Apon more, Jessore 9-10-2017
Mobile No: 01738532232 Yes

No.	Question	Answer				
A1)	How would you feel if table have footrest?	Like	Must be	Neutral	Live with	Dislike
A2)	How would you feel if table didn't have footrest?	Like	Must be	Neutral	Live with	Dislike
B1)	How would you feel if table have drawer?	Like	Must be	Neutral	Live with	Dislike
B2)	How would you feel if table didn't have drawer?	Like	Must be	Neutral	Live with	Dislike
C1)	How would you feel if the table has medium sized?	Like	Must be	Neutral	Live with	Dislike
C2)	How would you feel if table didn't has medium sized?	Like	Must be	Neutral	Live with	Dislike
D1)	How would you feel if chair have footrest?	Like	Must be	Neutral	Live with	Dislike
D2)	How would you feel if chair didn't have footrest?	Like	Must be	Neutral	Live with	Dislike
E1)	How would you feel if chair have hand rest?	Like	Must be	Neutral	Live with	Dislike
E2)	How would you feel if chair didn't have hand rest?	Like	Must be	Neutral	Live with	Dislike
F1)	How would you feel if chair have lumbar support?	Like	Must be	Neutral	Live with	Dislike
F2)	How would you feel if chair didn't have lumbar support?	Like	Must be	Neutral	Live with	Dislike
G1)	How would you feel if chair have seat comforts?	Like	Must be	Neutral	Live with	Dislike
G2)	How would you feel if chair didn't have seat comforts?	Like	Must be	Neutral	Live with	Dislike
H1)	How would you feel if table have space to keep bags?	Like	Must be	Neutral	Live with	Dislike
H2)	How would you feel if table didn't have space for bags?	Like	Must be	Neutral	Live with	Dislike
I1)	How would you feel if table is movable?	Like	Must be	Neutral	Live with	Dislike
I2)	How would you feel if table isn't movable?	Like	Must be	Neutral	Live with	Dislike
J1)	How would you feel if chair is movable?	Like	Must be	Neutral	Live with	Dislike
J2)	How would you feel if chair isn't movable?	Like	Must be	Neutral	Live with	Dislike
K1)	How would you feel if the tables have pen holder	Like	Must be	Neutral	Live with	Dislike
K2)	How would you feel if the tables didn't have pen holder	Like	Must be	Neutral	Live with	Dislike

Signature: sudipta Dey

Figure 2: Customer Survey Questions

Step 2: Use of the evaluation table

In step 2, an evaluation table was used to count and summarize the results. Table abbreviations represented: A (attractive), O (one-dimensional), M (must-be), Q (questionable result), R (reverse), and I (indifferent). Table 1 shows the Kano evaluation.

Table 1: Kano evaluation table

Customer requirements	**Dysfunctional**

If a customer chose "I like it" from a functional question and answered "Neutral" for a dysfunctional question, then the product feature was classified as an attractive requirement (A). If

		Like	Must be	Neutral	Live with	Dislike
Functional	Like	Q	A	A	A	O
	Must be	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live with	R	I	I	I	M
	Dislike	R	R	R	R	Q

a customer chose “Dislike” from a functional question and answered “Live with” for a dysfunctional question, then the product feature was classified as a reverse requirement.

Step 3: Determining the category

In step 3, determination of values for the product feature category occurred according to the answer frequency. Results were evaluated according to answer frequency. For determining the category, the procedure was if ((O+A+M) > (I+R+Q)), then the maximum value of (O, A, M) was adopted. Otherwise, the maximum value of (I, R, Q) was used. When two frequency results were identical, then the priority order M > O > A was followed.

Step 4: Customer satisfaction coefficient calculation

The customer satisfaction coefficient represented the extent to which satisfaction increased if a product requirement was met or the extent to which satisfaction decreases if a product requirement was unmet. It was useful to understand the average impact of product requirement with respect to the satisfaction of all customers. The calculation of this coefficient was as follows.

$$\text{Enhanced satisfaction coefficients} = \frac{A+O}{A+O+M+I} \quad \text{..... (1)}$$

$$\text{Reduced dissatisfaction coefficients} = \frac{O+M}{A+O+M+I} \quad \text{..... (2)}$$

5.2 Forces Field Analysis

Forces field analysis was developed by Kurt Lewin (1951) and Narayanasamy (2009). Force field analysis is important “for determining a situation by looking at both the driving and restraining forces that influence change in an organization” (Witkin & Altschuld, 1995). Lewin developed the technique based on the idea that a point of equilibrium existed within any system. Any proposed change caused a shift in the equilibrium. He indicated that change occurred in three phases: unfreezing, moving, and refreezing.

Ajimal (1985), Baulcomb (2003), and Parker (2013) applied the method to situations of varying complexity. For instance, applications included trying to hike certainty not only regarding the potential barriers involved in embracing an innovation, but also among many other situations. Force field analysis is applicable for both individuals and groups. It has been used profitably in conducting needs assessments with respect to various types of change.

The structure of the forces field examination encouraged people or gatherings to recognize the positive and negative forces that influenced change. Below, Figure 3 shows the forces field analysis framework.

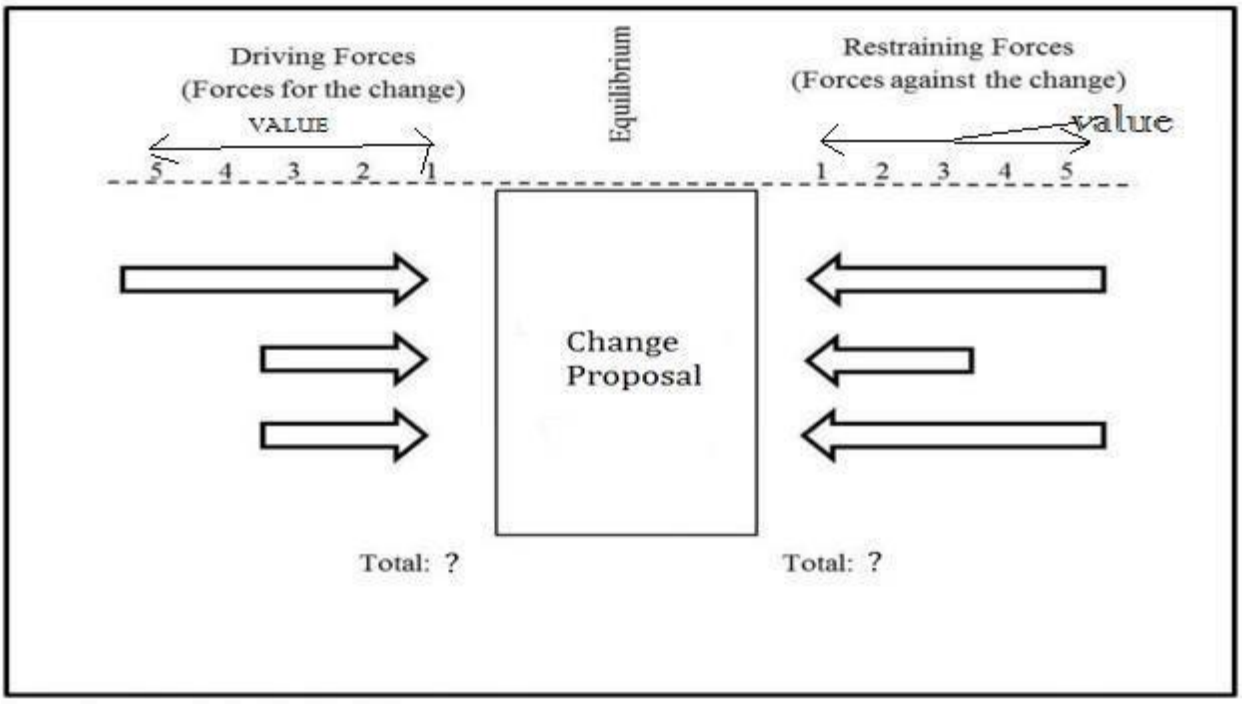

Figure 3: Forces Field Analysis Framework For

this study, the following steps were used to conduct force field analysis. a.

The center represents considered change.

b. All driving forces toward change are listed on the left side whereas all restraining forces against the change are listed on the right side. Within this study, the driving forces for change were: Students wanting improved furniture, improvement of the existing design, improvement of usability and comfort, maintenance costs increasing, and speed of design change.

Oppositely, the restraining forces against the change were: loss of maintenance personnel overtime, personnel afraid of new design, environmental impact, cost, disruption, no apparent reasons for changes proposed, lack of understanding of proposed changes, fear of inability to cope with new design

c. The importance of each force was scored categorically via a numerical range from one to five. The value of one indicated that the force held less influence. The value of five represented great influence. Students were asked to give opinions experiencing the existing furniture, reference questionnaire in Figure 2.

d. Generate score summation for each side. If the score for the driving forces exceeded that of the restraining forces, then it was recommended to pursue the considered improvement. Contrastingly, if the score for the restraining forces exceeded that of the driving forces, then it was recommended to further examine the considered improvement with respect to irregularity.

6. Results

Survey results are shown in Table 2. Table 3 shows the student's satisfaction coefficients for both the table and chair categories.

Table 2: Summary of multifunctional table and chair's Kano model questionnaire Results

Assessed characteristics	A	O	M	I	R	Q	Category
Provides footrest for table	12	15	**26**	6	2	0	M

Provides drawer for table	**18**	14	13	11	4	1	A
Medium sized table	12	10	**14**	20	4	1	M
Chair have footrest	14	**14**	12	13	7	1	O
Chair have hand rest	12	13	**17**	13	6	0	M
Chair have lumbar support	11	13	**23**	10	3	1	M
Provides seat comforts for chair	13	15	**23**	9	0	1	M
Table have space to keep bags	14	17	**19**	9	2	0	M
Table is movable	13	6	8	**21**	9	4	I
Chair is movable	**15**	7	11	18	7	3	A
Table have pen holder	**18**	7	6	22	7	1	A

Table 3: Student satisfaction coefficients for table and chair

Assessed characteristics	**Category**	**Enhanced satisfaction coefficient** $\frac{A+O}{A+O+M+I}$	**Reduced dissatisfaction coefficient** $\frac{O+M}{A+O+M+I}$
Provides footrest for table	M	.80	-0.69
Provides drawer for table	A	1.11	-0.48

The analysis showed that normal requirements included lumbar support, hand rests, foot rests, and seat comforts for chairs. Regarding tables, within the normal requirements included foot rests, bag space, and drawers. The study showed that expected requirements involved a medium-sized table, that exciting requirements indicated the desire for a pen holder among tables, and that indifferent requirements involve movable tables and chairs. Figure 4 shows the student's satisfaction coefficient diagram. From figure 4, we can summarize the following satisfaction level

a. Provides footrest for table - Normal satisfaction

Medium sized table	M	.56	-0.43
Chair have footrest	O	.91	-0.49
Chair have hand rest	M	.69	-0.55
Chair have lumbar support	M	.65	-0.63
Provides seat comforts for chair	M	.85	-0.63
Table have space to keep bags	M	1.03	-0.61
Table is movable	I	.45	-0.29
Chair is movable	A	.57	-0.35
Table have pen holder	A	.69	-0.25

b. Provides drawer for table - Normal satisfaction
c. Medium sized table - Indifferent satisfaction
d. Chair have footrest - Normal satisfaction
e. Chair have hand rest - Normal satisfaction
f. Chair have lumbar support - Normal satisfaction
g. Provides seat comforts for chair - Normal satisfaction
h. Table have space to keep bags - Normal satisfaction
i. Table is movable - Indifferent satisfaction
j. Chair is movable - Indifferent satisfaction
k. Table have pen holder - Exciting satisfaction

Application of Forces Field Analysis

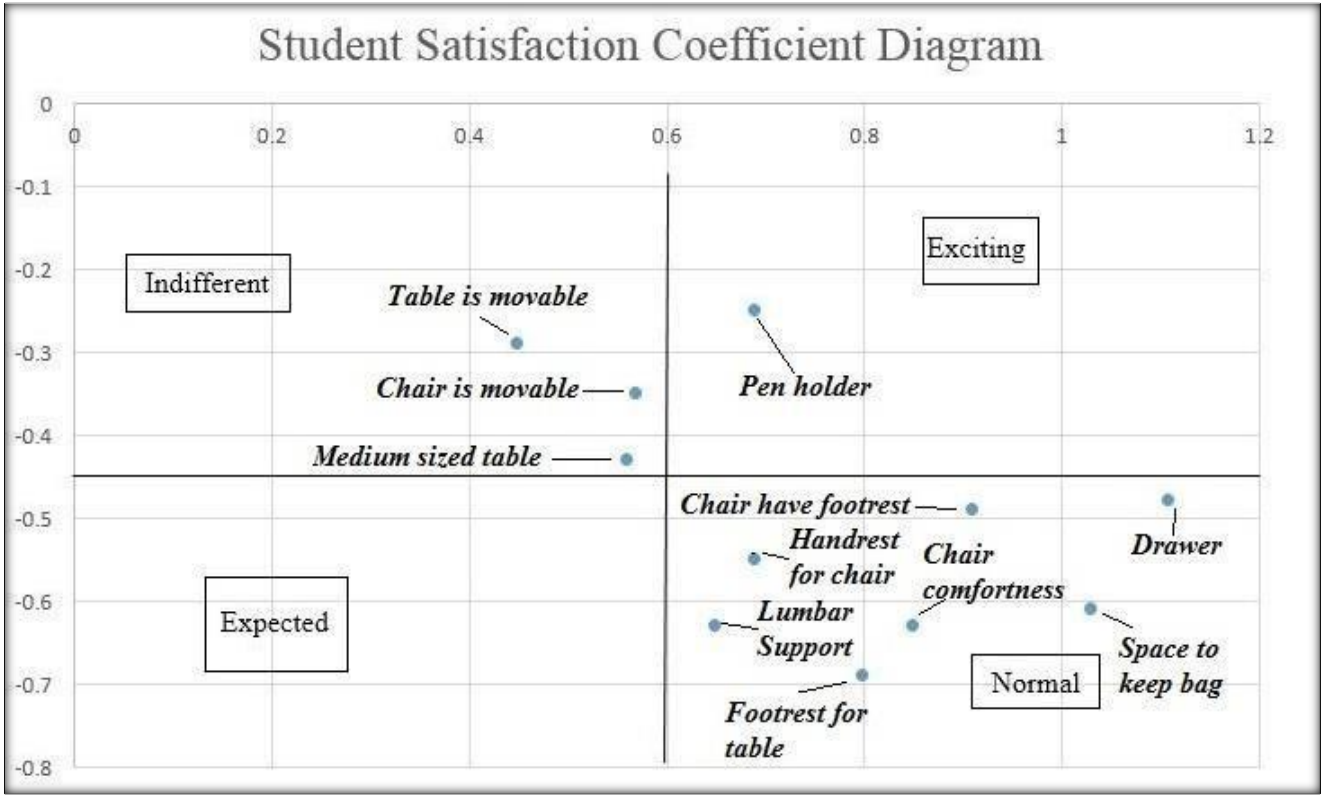

Figure 4: Student Satisfaction coefficient diagram

The participating total 61 students were asked to weigh the significance of each of the examined items. The value of five represented great influence whereas the value of one represented minimal influence. The value of three represented neither strong nor minimal influence. Values are shown in Figure 5 (Reference figure 3).

Forces For Change	Score	Change Proposal	Forces Against Change	Score
Students want improved furniture	5	Designing durable classroom furniture from existing furniture to raise satisfaction	Loss of maintenance personnel overtime	3
Improvement of the existing design	4		Personnel afraid of new design	4
Improvement of usability	5		Environmental impact	2
Improvement of comfort level	5		No apparent reasons for changes proposed	1
Speed of design change	3		Lack of understanding of proposed changes	1

Figure 5: Application of forces field analysis

Finally, summation scores were generated for each side. A summed value of 24 showed driving forces toward change whereas a summed value of 21 represented restraining forces against change.

7. Discussion

Maintenance costs increasing	2		Fear of inability to cope with new design	3
			Cost	4
			Disruption	3
Total	**24**		**Total**	**21**

Regarding application of the forces field analysis (Figure 5), the driving force score (24) exceeded the restraining force score (21). Therefore, the recommendation for pursuing the new furniture design was favorable. The Kano survey results were used to generate a final classroom furniture design for the table and chair categories that was deemed satisfactory with respect to the determined human needs. Figure 6 shows the existing design of the table and chair. Figure 7 and Figure 8 show the picture of the recommended table and the recommended chair, respectively.

Figure 6: Existing design of Table & Chair

Figure 7: Design of Table

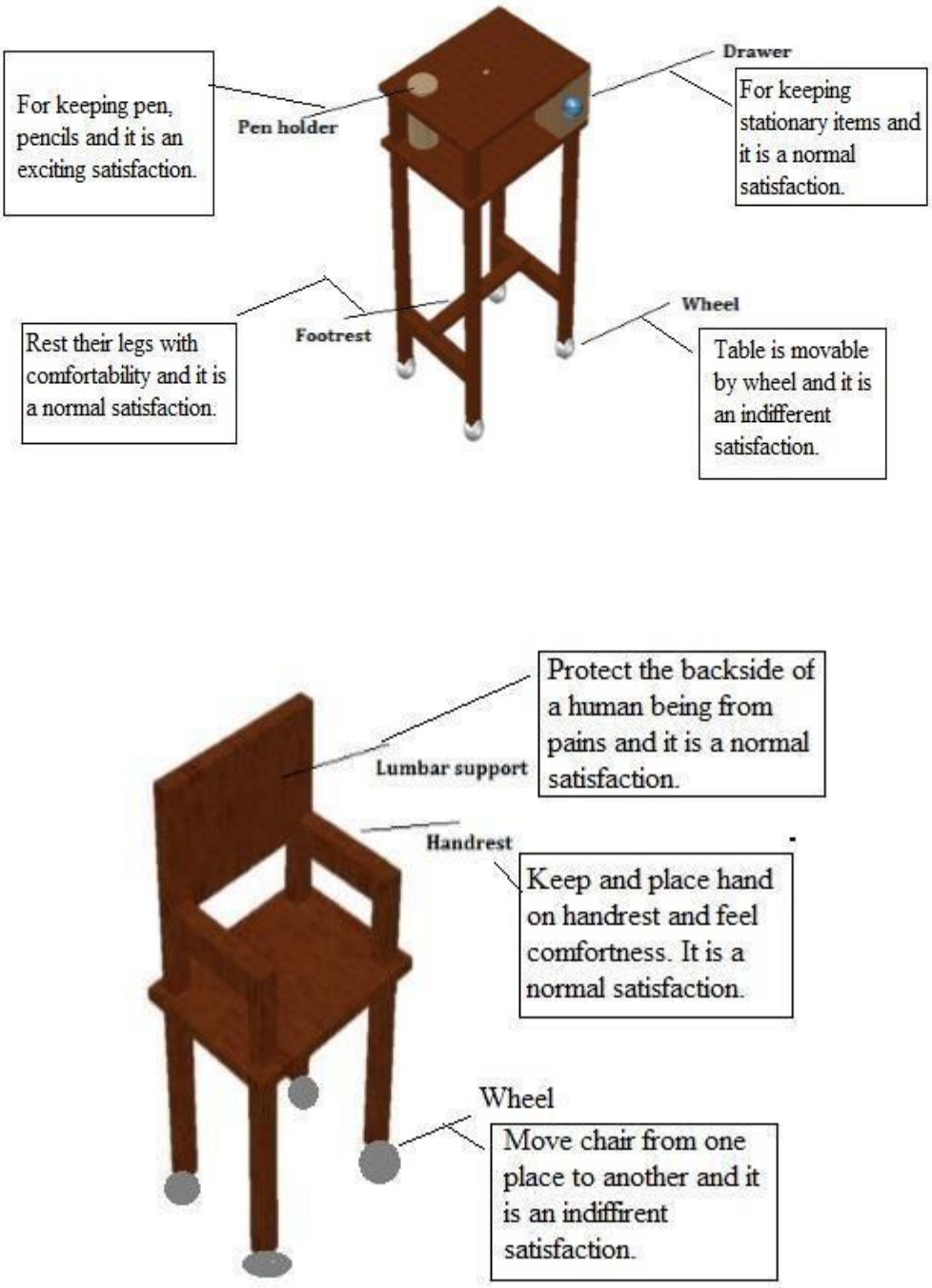

Figure 8: Design of Chair.

The main objective of this study was to design durable classroom furniture to raise the satisfaction levels among student users of classroom furniture. Reviewing the Kano survey results showed that if the considered requirements were added to tables and chairs, student concentration may improve. The students indicated that their level of satisfaction would increase if a pen holder existed in the table. This observation is commensurate with the discussions of Yamamoto, et al., (2015) and Bartlett (2015) regarding the notion that learning is enhanced with respect to the incorporating of quality and ergonomic design characteristics among modern classroom furniture designs. In short, satisfaction based attributes obtained can be used in the formation of design features.

The Kano survey results also showed that if the chair had footrest, it was deemed to be of greater comfort when sitting. Such findings are commensurate with the discussions of Kroemer and Kroemer (2017) regarding comfort with respect to ergonomic furniture design involving individual preferences and habits. Additionally, these features may also contribute to avoiding physical pain and musculoskeletal disorders (Hedge, 2017). Through the Kano method, the higher education institution gained a basis for the addition of requirements to its classroom furniture resources.

8. Conclusion

This study provided insight of Kano analysis of student's satisfaction regarding selection of design features for development of traditional/ existing classroom desk-chair design at a Bangladeshi higher education institution. The analytical outcome of the force field analysis indicated that the value of driving forces for change (24) were greater than the value of restraining forces against change (21). In other words, analysis of the survey responses showed that students tended toward favorableness toward the new furniture design. Thus, it was recommended that the institution pursue the new design attributes.

The higher education institution gained a better understanding of what classroom furniture attributes were necessary for improving student satisfaction levels. The new design incorporated a variety of characteristics that had the potential of improving human convenience and bolstering satisfaction levels. The survey experience revealed that students desired greater variety and increased amounts of features in classroom furniture design. Specifically, the study revealed that the addition of wheels, pen holders, foot rests, and drawers may improve satisfaction levels. Such features may not only improve comfort and satisfaction levels, but also enhance student learning.

This study examined a solitary case of human satisfaction with respect to furniture design. Thus, it lacks generalizability for all higher education institutions. However, despite the lack of universal application, the study may have transferability for similar institutions. Given this notion, it is recommended that future studies examine the perceptions of respondents among additional higher education settings wherein the existing furniture designs are implemented with respect to respondent opinions of the new furniture design. In doing so, opportunity may exist to affect the learning environments of multiple universities and colleges.

Higher education settings are not the only locations where desk and chair combinations are implemented for work or learning. Therefore, it is recommended that future studies examine other organizations where the same (or similar) furniture designs exist. Thus, this study may be repeated using a different population and context. In doing so, additional opportunity exists to examine the perceptions of individuals among settings that are external to higher education.

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