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"Rethinking Built Environment: Towards a Sustainable Future"

Organiser:
Research, Industrial Linkages, Community & Alumni Network (PJIM&A)

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Department of Built Environment Studies & Technology (JABT), Faculty of Architecture, Planning & Surveying (FSPU)

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Sustainable Prayer Chair Design Characteristic For People With Disabilities

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Abstract
Muslims need to fulfil their duty by performing solah five times a day that is compulsory. However, people with disabilities face some difficulties due to loss or changes in their body structural functionality. Praying in a chair could be a beneficial option for individuals that could not go for years. Less attention is given to the uncomfortable congregation when performing solah, which is a significant concern to all Muslims during prayers. For this reason, this paper focuses study on the characteristic of sustainable prayer chair design for people with disabilities. Data were drawn from the available literature on solah, disability, sustainability, and usability, anthropometric and ergonomics, and aspects of furniture design. Data were analysed through the content analysis method. The results were a composition of understanding the requirement and characteristics of the sustainable prayer chair design for disabilities in terms of functional and aesthetic and the expectations for the environment. Consequently, the components that contribute to the standard appearances and usefulness of the physical user were reviewed and discussed. The findings provide a structural understanding of functional versus aesthetic characteristics of prayer chair design.

Keywords: Prayer Chair Design Characteristic, People With Disabilities, Chair Design.

1.0 Introduction

User-centred design and aesthetics ensure that innovations are improved when designed better for the worth of product creation. The aesthetic and usability features influence people's aesthetic, interpersonal and communications preferences. This research focuses on the issue of planning and design aspects of mobility chairs. A good design must take into consideration such things as functionality, size, proportion, reach and positioning. Praying in a chair could be a beneficial option for individuals that could not go for years. Less attention is given to the uncomfortable congregation when performing the solah which is supposed to be a major concern to all Muslims during the time of prayer. The appearance of the environment and products can make people much easier for deciding to buy the products.

The performance of research and development projects in the field of Prayer Chairs is marginalised under the current situation. Recent prayer chairs at mosques are not designed properly for Muslims with disabilities and may affect Muslims as to their actions or behaviour during their prayers. Therefore, this research is intended to apply the Universal Design approach to identify the characteristic of prayer chair that is versatile and practical for all user classes. This research outlines a discussion of the Universal Design approach, outlining the aesthetic and value aspects of this approach. Aesthetics is an important element to design because it makes something beautiful. The inherent relationship between planning and attractiveness may exist for products and their buyers (Lidwell, Holden, & Butler, 2003). This study was aimed at analysing the functional and aesthetic factors of the prayer chair. This product is a functional-aesthetic product due to its incredible design and dynamic power. (Seymore, 2010).

1.1 Problem Statement

In the process of defining the needs of disabled congregations while they are performing the solah, the study should begin with the root itself which is the cause of problems and effects to the group of studies.

This problem statement would support the need of this research and future undertakings until it is complete. The cause and effect approach is used to describe a relationship between events or phenomena that factor the probable problems related to inadequacy in design and functional criteria of sustainable prayer chair for a disability that has been used in mosques in Malaysia as illustrated in Figure 1.

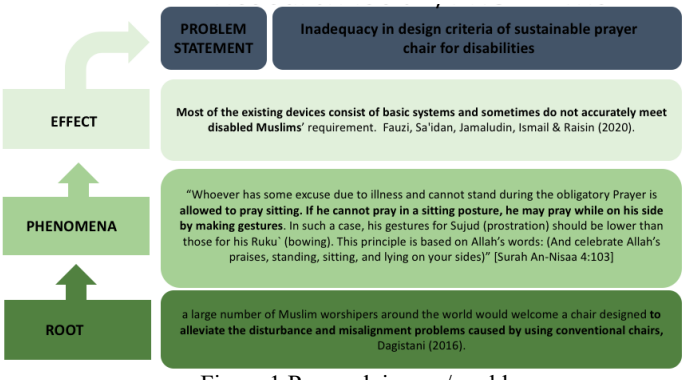

Figure 1:Research issues / problems

According to the verse 4:103 of Surah An-Nisaa, Muslims must pray five times a day, and, if disabled, they should seek help from others in the performance of prayers. However, Fauzi, Sa'idan, Jamaludin, Ismail & Raisin (2020) address the issue most of the existing devices do not completely satisfy the needs of disabled Muslims because they do not meet all the needs of all disabled Muslims. This group of researchers find that the design of the existing prayer chair cannot effectively meet the requirements of users. As consequence, many Muslims would welcome a chair designed to minimize damage to spinal discs caused by regular chairs, (Dagistani, 2016). Therefore, based on the above remarkable disparities, this study was conducted to observe the difficulties and problems that users face when sitting in a prayer chair as illustrated in Figure 1.

1.2 Scope of Research

This study is an investigation on the characteristics of the mosque users and worshippers who had a limitation on performing the solah itself. On the contrary, the problems of the design and functionality generated by end-users affected by problems were problematic. Data were drawn from the available literature on solah, disability, sustainability, and usability, anthropometric and ergonomics, and aspects of furniture design. Data were analysed through the content analysis method. The results were a composition of understanding the requirement and characteristics of the sustainable prayer chair design for disabilities in terms of functional and aesthetic and the expectations for the environment.
Disabilities category:
To get richness in design and functionality criteria, the scope of disabilities will be covered are:

i. Any difficulties when performing solah cause of illness.
ii. Any difficulties when performing solah cause of natural defects.
iii. Any difficulties when performing solah cause of ages.
iv. Any difficulties when performing solah cause of accidents.

2.0 The Process of Research

These studies have adopted phenomenological epistemology because it is concerned with understanding human experience. In connection with disabilities because of the characteristics of architecture. The statistical research has to be operationalized so that it can be measured, and the interpretation of the research will be required to be purposive Easterby-Smith et al, (2008). In conclusion Phenomenology approach is considered due to the research scope to determine what and how people experience the aspect of performing solah with a disability. When constructing literature

analysis, the four necessary steps are frequently mentioned:

i. Bracketing - this is the process of identifying and suspending preconceived thoughts and attitudes about the phenomena study. To address the facts in their purest form, the researcher removes the context and any presuppositions that may be there. This is regarded as the essential component of phenomenological reduction, in which authentic phenomena are isolated based on what is already known about the event.
ii. Intuition - after bracketing is completed, intuition takes over, with the researcher remaining focused on the phenomenon's associated meaning as determined by the preceding research. Shared knowledge of a phenomenon on whatever is being investigated is achieved through this method. To make this process go as smoothly as possible, the researcher should offer the data variance until everyone is on the same page. As a result, this procedure necessitates the researcher's immersion in the study and phenomenon under investigation.
iii. Analyzing – after completing the intuition process, the following stage is to conduct an analysis. Coding is done in this phase, which involves categorising and making sense of the phenomenon's significant meanings. The formation of essences and universal themes emerges from persistent labour with comprehensive data.
iv. Describing - The description is a crucial phase in any phenomenological research approach. The researcher's comprehension and definition of the phenomena take place at the descriptive stage. This serves as the final step in the communication process, providing distinctions and critical descriptions in both written and spoken form.

The research onion offers an efficient progression by which it is possible to design a research methodology. Its value lies in its adaptability to almost any kind of research methodology and can be used in several contexts, Bryman (2012). This thesis will discuss and describe the various stages of the study onion, and at each point will explain the concepts. It will begin with case study techniques for this phenomenology study in ways of collecting data in the multi qualitative method system. The theories of interpretivism will be studied from the data collected then.

3.0 The Study

The process of development of the main finding is produced based on the theoretical framework obtained from the literature analysis. The discussion of this section is structured as follows:

i. Firstly, the discussion of the research findings will be presented by adopting a cross-case study discussion in which the similarity of the usability parameters and the attributes.
ii. Secondly, organizing the findings of the six domains that primarily influence the factors for the usability parameters.
iii. Finally, the conclusion is based on the results of the three cases and reflection on the development of a characteristic prayer chair for disabilities based on the usability criteria and its parameters.

This section critically examines the justification behind this research and issues related to the research project. This part focuses on the pragmatic aspect of the usability and design quality of the prayer chair for the disabled and how it ties in with its usability and design. This literature analysis is split into five parts.

A. Scenario of Muslims with a disability performing their solah.
B. Common type of disabilities.
C. Sustainability and usability.
D. Anthropometric and ergonomics for disabled. What is furniture.
E. How furniture as a tool will help people.

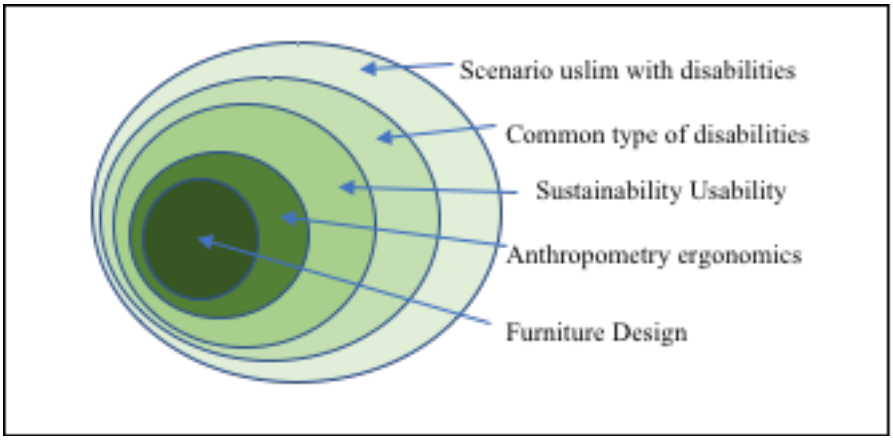

Figure 2: Literature analysis context using Onion structure.

3.1 Solah in Islam

According to the book "Mutawalli Sya'rawi" (2007), by Abu Daud, the Prophet S.A.W is quoted as saying, "A Muslim differs from a non-Muslim because of the time of prayer, and whoever stops attending prayers is a non-Muslim." This narration attests that the act of worshipping on time is essential. There are thirteen rules or pillars to consider when undertaking a salat. Some of these rules are (i) The stand for the capable, (ii) intent, (iii) takbiratul of ihram, (iv) reading the Al-Fatihah, (v) Bowing, (vi) Iktidal, (vii) to perform two prostrations, (viii) to sit between two prostrations, (ix) to sit on the last tahyat, (x) to read the last tahyat, (xi) to make salawat to the Prophet, and (xii) to first greet. If any of these prayer pillars is abandoned, the prayer is negated. improvement is emphasised in many of the hadiths of the Prophet Muhammad (concentration).

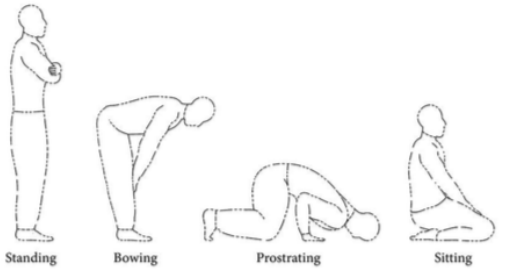

Figure 3: Solah Movements

3.2 The Scenario of Muslims With a Disability Performing Their Solah

Muslims need to fulfil their duty by performing a solah five times a day that is compulsory to them. However, people with disability find that they are facing some difficulties due to loss or changes of their body structural functionality. Yaman (2003) explains that structural changes are referred to as loss of habitual stability and mobility and loss of balance. Flexibility is in particular an age-diminishing physical fitness parameter (Taunton & et al, 1996). However, kneeling during priesthood is a widely held position in Muslim societies; therefore, several extreme bending movements may occur in the lower limb joint during prayer. According to Ünver et al. (2009), among 50 subjects who frequently prayed for 5.7 years and 50 subjects who did not pray, the outer thigh of the prayer, leg length, ankle dorsi, plantar bending of both the active and passive thighs and knee motion angles values were substantially higher than the non-prayer angles.

Solah consists of long and short periods of standing, bowing, bowing and sitting on the platform or the ground. Unfortunately, many worshipers cannot assume all appropriate positions of their body because of age, sickness, pregnancy, etc., and must rely on a support system (usually a traditional chair) to enable them to achieve roles they cannot take on or find difficult to take on (Dagistani, 2016).

3.3 Common Types of Disabilities

According to the Cambridge Online Dictionary disabilities can be defined as an illness, injury, or condition that makes it difficult for someone to do the things that other people do. On the other hand, Somnath, Bedirhan and Jerome (1999) explains disability is the difficulties in carrying out tasks, encompasses all ways in which the accomplishment of an activity may be affected and includes pain, stiffness discomfort, slowness and awkwardness. Referring to this statement it can be classified as a person with limitation of movement or incapable of performing the solah according to the pillar of solah can be classified as a congregation with disabilities. For this study, the categories of disabilities are classified as disabilities natural born, disabilities by ageing, disabilities by illness and accidents.
People with physical/mobility disabilities are also more likely to miss opportunities to be physically active compared to adults without disabilities and have more difficulty engaging in physical activity due to physical barriers in the built environment, (Rimmer, Padalabalanarayanan, Malone, & Mehta, 2017).

3.4 Sustainability and Usability.

Studies on usability are a cultural phenomenon for understanding the experience of people. It is part of human nature to esteem the happiness of the customer. Environmental sustainability has a good interaction with society's natural and economic environments and increases the quality of living in urban society (Baper & Salahaddin, 2018). Referring to this statement sustainability is a study to prolong the ecosystem with green properties that will ensure no harming on user and environment, where else the usability is the degree to which something is able or fit to be used. This sustainability and usability is important for the designers and can be used as criteria in designing so the design item is fit for users and serve the best purpose without harming both environment and users themselves.

To achieve balanced manufacturing and use habits, the integration of environmental awareness into the product creation process is a crucial consideration. This integration is not enough, though. There is largely a metaphysical and conceptual body of sustainable design (Walker, 2006), with just a few functional components inherited from Eco-design, (Tischner, 2001). The recognition of these two statements should be the foundation for the design community to work on: the design process must incorporate all sustainability-inherent requirements and must do it efficiently and realistically. The mandatory improvement in productivity in the usage of energy and material materials, which both the design process and the product system need to implement, is another crucial factor. The research and production of unique techniques and resources focusing on the operation market, which are dependent on the life cycle review of the product range, is a way to facilitate this (Hemel, 1998).

3.5 Anthropometric and Ergonomics.

Anthropometrics provides detailed information about the dimensions and functional capacity of the human body, the science dealing specifically with the measurement of the human body to determine differences in individuals while ergonomics is the application of human-factors data, including anthropometric data (Mitton, 2016).

The biggest task is to build a physically pleasing and supportive chair that fits most users' body proportions and can be tailored to their personal needs. Therefore, by responding to this argument, anthropometric data relevant to the design of chairs collected often provides the image that the anthropometric is necessary to research the prayer chair for disabilities where the user's data requires to be collected as a guideline. The anthropometric refers to the human size and stance that the prayer

chair consumer focuses on (Dagistani, 2016).

Anthropometric data is a collection of the dimensions of the human body and is particularly relevant to clothing sizes, physical anthropology, and the study of the human body in forensics, physical anthropometry, and ergonomics in the workplace. as that utilised in ergonomics to characterise workplace, equipment, furniture, and clothing."

The use of furniture that was created up to the Stone Age began around 4000 BC when tables and chairs were carved from rocks and stones. Chairs were, similarly, included in any learning environment, as mentioned by Thariq et al. Despite a multitude of studies on the ergonomic issues that are linked to the use of school furniture, not much progress has been made. Surveys have proven that older people spend a large portion of their time seated in nearly every location. Static and extended sitting postures are the primary cause of low back pain. For his research, Mandal found that sixty per cent of students reported pains in the lower back, neck, or shoulder (O Ismaila, Musa, B Adejuyigbe & D Akinyemi 2013).

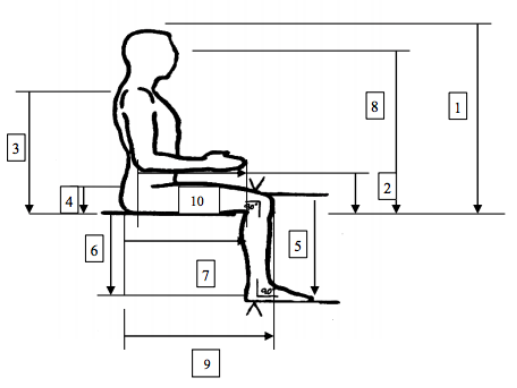

Figure 1. Measured anthropometric data.

Legend

1- Sitting Height	2 - Sitting Elbow height	3 - Sitting Shoulder Height
4- Thigh Clearance	5 - Knee height	6 - Popliteal Height
7- Buttock-Popliteal Length	8- Eye Height	9 - Buttock-knee Length
10- Forearm- Hand Length		

Sources;https://Ergonomicsuk/anthropometry/sitting/

Figure 4. Anthropometry sitting measurements

3.6 Furniture Design and How Furniture as a Tool Will Help People

Furniture is the movable articles that are used to make a room or building suitable for living or working in, such as tables, chairs, or desks. Postel (2012) highlights, furniture is deeply rooted in the human condition as it belongs to the humanities, applied art that draws upon many design disciplines, and is dependent upon a working knowledge of materials and fabrication techniques. Referring to this statement, prayer chairs can be as a seating purpose in performing salah and used by disabled Muslim congregations.

People's convenience, physical wellbeing, well-being, and performance may be increased by developing products, foods, furniture, and other equipment according to the needs of the human body. One of the efficiency-promoting standards is to ensure that the workspaces and services utilized by citizens conform to the anthropometric and biomechanical characteristics of the consumers. Ergonomics measures the physical measurements of workspaces, appliances, furniture and garments using anthropometric statistics (Bridger, 1995; Kayis and Ozok, 1991; Jeong and Park, 1990). Proper usage of anthropometry in design will increase the well-being, health, comfort and safety of a product's consumers (Pheasant, 1998; Barroso et al., 2005). According to Gustafson (1995) usage of badly constructed furniture, especially school desks and tables, which does not take into consideration the anthropometric characteristics of its customers, hurts human health.

The device provides the user with active real-time feedback to help prevent invalid designs, either

because of violations of stability or because of excessive joint bending forces. To produce several recommendations, along with valid deformation ranges, including continuous and discrete geometric shifts, a new force-space analysis is proposed for both bending forces and frictional constraints. To design a selection of furniture, we used our system and also demonstrated the usefulness of the system by constructing a physical prototype. In this area, much remains unexplored. We want to do so in the future.

Ensure validity for dynamic furniture, such as the nature of physical furniture valid the chair for rocking. A potential solution is to resolve the issue of a combined exploration of different shapes based on touchpoints to the ground and the relative orientation of the earth (upright), form. Subsequently, at the same time, we may discuss the various forms, thus incorporating a term of regularity to favour improvements that are consistent across all shapes (since correspondence is known), finally, intend to encourage shape design experimentation involving a large number of components, e.g., building design, etc. (Umetani, Igarashi & Mitra, 2012).

3.7 Design Aspect

The word "design" is widely used in fields of architecture, industrial, art, and engineering, for example, was discussed in broad terms and never end until today in terms of aesthetics, function, trend, technologies, and values. Hertenstein, Platt And Veryzer (2013) reports, good design must emphasize form, function, sustainability, usability, emotions, and feelings. In contrast, the evaluation of the prayer chair's universal design factors consists of seven factors known as use equity, use versatility, easy and intuitive use, perceptible knowledge, error tolerance, low physical effort, and last but not least, approach and use size and room, Musdi Shanat (2018). Based on this report, the factors leading to design to achieve uniform design were identified. This is the list of items that should not be abandoned by designers and can become a common guideline for architecture.

3.8 System and Function of Furniture

One experiment conducted by Dagishtani (2015) regarding the configuration of the prayer chair was not taken into consideration when making the prayer chair and, the findings suggest that the most prayerful place chairs are used for prostration. It can be clarified from this research that the configuration of the prayer chair must be constructed according to the system and purpose of the prayer chair to function entirely as a prayer chair.

On top of that, Ningrum, Kusuma, Alimin & Purwaningrum (2020) claims their study indicates the armrest and seat support influence the length of the shift of the role of the participant from sitting to standing, and it also affects their reaction and can be seen as a factor in the construction of elderly prayer chairs.

Mechanical design is dedicated to making ruku' and sujud (bowing and prostration) have different degrees of depth. The salah chair mechanical design is illustrated in Figure 2 and the front view is shown in Figure 3. A solah chair's flexible seater, adjustable sujud panel, and hydraulic system's levelling arm are all used in the chair's construction. To adjust the level and the degree of the sujud panel, the hydraulic system levelling arm is used. With this sujud panel, users will be able to tell the degree of sujud from ruku' (Fauzi, Sa'idan, Jamaludin, Ismail, Naeem, & Raisin, 2020).

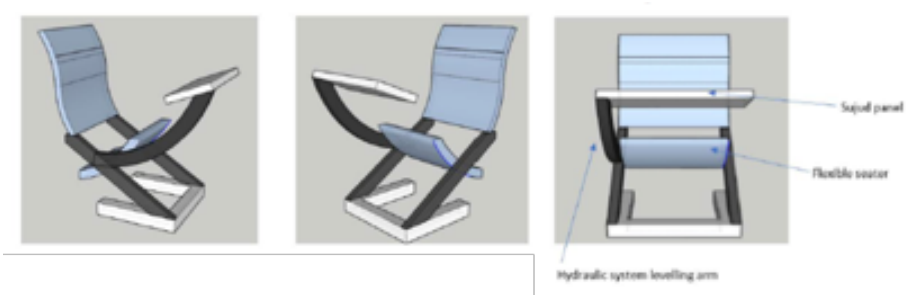

Figure 5. Design created by Fauzi, Sa'idan, Jamaludin, Ismail, Naeem, & Raisin.

Another source cited by Liu Yong-Xiang and Li Jie (2006) mentioned that it should be simple and efficient for both beginners and experts to create the product. A simple example is when the designers are creating a dual-purpose product. In this case, they must take into consideration both utilitarian and emotional purposes. In other words, utilitarianism involves dealing with the pleasure and pain results. On the other hand, emotional processes get to know people's unique circumstances and lifestyles, such as whether they live in a city or rural area, as well as their education levels. Design should not neglect aesthetic elements, but must also meet traditional expectations. Wu (2009) claimed that an ideal seat must conform to human body shape, support when in use, and be tailored to the user. Consumer style design concept also must be considered in addition to the comfort factor. Cultural influences in the design must be factored in; the good design does not only rely on the shape, colour, and form, but also includes the marketplace's natural resources, for example, the number of people, weather conditions, and availability of resources.

4.0 Analysis Findings

This study is intended to identify prayer-chair design characteristics for disabled individuals. Usage evaluation framework in which the quality of the prayer chair design is heavily influenced by the nature of the user experience. This goal was accomplished by analysis of literature using content analysis. An exhaustive analysis of the literature and current usage studies of prayer chairs led to the research area and gaps being discovered. The framework for measuring the usability of a product was developed by blending theories related to user experience, usability, and quality. That case study framework has been applied in the majority of cases. Three cases of usage were used to fine-tune the usability evaluation framework after that. The literature reviews analysis and validation results are synthesised into this section to allow for a clear picture of the important facts in the article. By investigating how it was managed and reported, we will be able to get a better idea of the research objectives.

The five contexts of literature are: Scenarios of Muslims with disabilities, Common types of disabilities, Sustainability usability, Anthropometry ergonomics and Furniture design are the peripherals of the literature analysis that can drive the characteristics of prayer chair design for disabilities.

The first literature context which is scenarios of Muslims with disabilities can outline the first criteria which is the designed chair should have support systems for a disabled person in performing solah which follows the rules of solah itself such as standing, bowing, prostrating, and sitting. This designed chair also need to take concern not to create disturbance from using the chair to other Muslims congregations.

The second literature context is a common type of disabilities contribute to second characteristic which is the designed chair should consider standing and sitting postures. This is because disabilities congregations are normally cannot withstand the transition between rules and sometimes become imbalanced and easy to fall.

The third literature context is sustainability usability precisely made up the third characteristic which is the designed chair should use durable materials that could support the weight of worshipper such as the metal frame for the structure of designed chair and mechanism for easy storage.

The fourth literature context is anthropometry ergonomics are outlined the fourth characteristics which are size of the designed chair is should have 43cm of height of seater from floor 40x 40 cm size for the seater and 80 cm of backrest height from the floor, the size must cope the 92 % tile of average Muslims congregations.

The last literature context is the furniture design aspect which contributes to the last characteristics of the prayer chair which is the design must serve the functions of a prayer chair (form follow functions) so it will not only good in aesthetic but usage too. To determine the good design of prayer chairs design for people with disabilities these five contexts can drive the solution for the characteristics.

5.0 Conclusion

In this research, a novel characteristic prayer chair design for disabilities is discussed. Such a chair is specially designed to provide the necessary support for certain worshipers who take part in Muslim congregational prayers. At present, such worshippers rely on conventional chairs for assistance in achieving positions of prayer that they cannot assume. Unfortunately, the use of such conventional chairs causes disturbances to worshipers in the row behind the chairs or/and misaligns their users with prayer rows. These problems are well known to all Muslims who pray in mosques because they occur repeatedly in almost every mosque around the world. Many Muslim scholars have also discussed Islamic prayer rules with the support of chairs. They pointed out the importance of aligning the user of the chair with the prayer row and, at the same time, the importance of not causing disturbance to the worshipers in the row behind the chair. However, these two conditions cannot be met at the same time when using conventional chairs. The challenge of this study was therefore to highlight the characteristics of the design of the prayer chair for disabilities, which specifically addresses the problems referred to above and, at the same time, considers the principles of ergonomics. Based on the literature review analysis of the usability study conducted. It is expected, God willing, that Muslim worshipers around the world would welcome these features of prayer chair design for disabilities to become guidance in designing prayer chairs to ease processes in design and provide adequate support to achieve all the prayer positions required.

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