

## The Impact of Indoor Environmental Quality on Interior Design and Its Effect on Individuals Behavior at Home

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### أثر جودة البيئة الداخلية في التصميم الداخلي وتأثيرها على سلوك الأفراد في منازلهم

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#### Abstract

Interior design plays an important role in designing the indoor environment of the house. It helps create the physical environment for indoor spaces and facilitates the daily activities of the individuals who live in these spaces, thus leading to the promotion of positive behavior among them, which in turn is a major criterion for measuring the success of the interior design of the house in providing a comfortable, safe, and healthy environment for its dwellers.

The research problem is: How can the quality of the components of the indoor space help meet the individuals' need for comfort, safety, luxury, and privacy? This research aims to provide information on the effect of the quality of the components of the indoor environment on the behavior of individuals inside their homes. The methodology used in this research is the analytical descriptive method. A statistical program (SPSS) was used after the collection of data .

General research results have proved the effect of the quality of the components through: 1) The use of comfortable and calm colors increases comfort, luxury and health of individuals, which reflects positively on their behavior, productivity and loyalty within their housing. 2) Designing comfortable and suitable lighting improves positive behavior of individuals inside their residences. 3) The distribution of furniture in the ideal studied manner ensures comfort and luxury that provides satisfaction and reassurance. 4) Good ventilation creates an environment that is safe, healthy, and free from diseases by eliminating moisture, mold, bacteria, insects, and different pollutants. Finally 5) Customizing indoor spaces for individual dwellers is inside their housing increases their levels of privacy.

**Keywords:** Indoor Environment, Individuals Quality, Interior Design, Behavior, and House.

#### الملخص

يلعب التصميم الداخلي دورا هاما في تصميم البيئة الداخلية للمسكن، وذلك عن طريق تهيئة الفراغات الداخلية التي يتم فيها ممارسة النشاطات اليومية للأفراد بسهولة ويسر، مما يؤدي إلى تعزيز السلوك لدى شاغلي المسكن وهو واحد من أهم عناصر قياس نجاح التصميم الداخلي. كل ذلك يتحقق من خلال التركيز على مكونات البيئة الداخلية وجودتها وصولا إلى مسكن نموذجي يحقق سلوكا إيجابيا مما يعزز الولاء والانتماء والاستقرار لجميع أفرادها. تتلخص مشكلة البحث في حاجة الأفراد إلى الراحة والرفاهية والصحة والأمان والخصوصية، فكيف يمكن لجودة مكونات البيئة الداخلية في تصميم المباني السكنية أن تحسن السلوك عند الأفراد؟ ويهدف هذا البحث إلى تقديم معلومات أكبر عن تأثير جودة مكونات البيئة الداخلية على سلوك الأفراد داخل سكنهم. المنهج المتبع في هذا البحث هو المنهج الوصفي التحليلي، ويأخذ عدة أشكال مثل المسح النظري أو الميداني. تم استخدام برنامج إحصائي (SPSS) بعد جمع البيانات من خلال الاستبانات والمقابلات الشخصية والوثائق والمنشورات والكتب والمقالات السابقة والإنترنت.

أكدت نتائج البحث أن استخدام الألوان المريحة والهادنة تزيد من الراحة والرفاهية والصحة والأمان، وأن تصميم الإضاءة المريحة والمناسبة يحفز السلوك الإيجابي عند الأفراد، وأن توزيع الأثاث بالطريقة المثالية المدروسة يؤمن للأفراد الراحة والرفاهية، وأن التهوية الجيدة تهيئ بيئة داخلية آمنة وصحية وخالية من الأمراض من خلال القضاء على الرطوبة والعفن والبكتيريا والحشرات والأتربة والملوثات المختلفة، وأخيرا فتخصيص مساحات للأفراد داخل سكنهم يزيد من رفع مستويات الخصوصية عندهم. الكلمات المفتاحية: البيئة الداخلية، الأفراد، الجودة، التصميم الداخلي، السلوك، المسكن.

## **Introduction**

The quality of the components of the indoor environment plays an important role in the design of various residential environments (Du, et al., 2015), as it affects the behavior of individuals (Geng, et al., 2017), positively or negatively, while exercising their various daily activities (Alhorra, Y. et al., 2016; (Ajimotokan, 2009; Sujanova, et al, 2019; Abu Zaarour, 2013). The most important components of the indoor environment that must be taken into account during the housing design process are: the appropriate color, comfortable lighting, thoughtful furniture, adequate ventilation and sufficient space (Alhorra, Y. et al., 2016; Ajimotokan, 2009; Sujanova, et al, 2019; Abu Zaarour, 2013). All of these components have a real impact on the behavior, comfort, luxury, productivity, and loyalty of individuals within their housing (Kim, et al., 2017; Lai, et al., 2009; Marino, et al., 2012). This research is based on studying the quality of the components of the interior environment of individual homes, which is one of the fundamentals of sustainable interior design in order to obtain an ideal indoor environment that enhances individuals' daily activities within them in order to reach a practical environment that serves individuals and their daily requirements easily and conveniently.

## **Objectives of the Study**

The main objective of this study is to study the components of the interior environment (colors, lighting, furniture distribution, ventilation, privacy and freedom of movement) and its impact on the positive behavior of individuals within their housing.

## **Purposes of the Study**

Obtain valuable results showing how the quality of the indoor environment affects the residential interior design (color, light, ventilation, furniture, personal space), which in turn impacts the behavior, comfort, psychological welfare, productivity, and loyalty of individuals in their housing. The study will explore the factors that influence behavioral, psychological, and physical comfort in the indoor residential environment

## **Problem of the Study**

Individuals spend 90% of their time indoors (Altomonte, et al., 2017), 66% of them doing their daily activities in the house (Kamaruzzaman, et al., 2017). Several studies found that staying indoors is not good for human health (Bluyssen, 2019; Nimlyat & Kandar, 2015). The indoor environments in buildings affect human health and behavior in the same levels (Kishi, et al., 2020; Zalejska-Jonsson & Wilhelmsson, 2013). The main problem is apparent in the scarcity of scientific research looking at the quality of the components of the internal environment of a Jordanian home in particular and the Arab world in general and its impact on the positive behavior of individuals within their homes.

## **Imp**

Studying the elements that make up the interior environment of the interior of the Jordanian house in a quality manner will have a clear impact on comfort, safety, luxury, and privacy, which will be reflected in the positive behavior of individuals.

## **Questions of the Study**

The main questions are:

1. How can the quality of the components of designing residential buildings improve the positive behavior of individuals?
2. What is the role of quality in components of the interior environment in achieving an ideal exemplary design for these housing units?
3. What is the effect of interior design on the behavior, comfort, welfare, and health of individuals within their housing?
4. What is the impact of that on the productivity, performance, and loyalty of the residences?

### **Limitations of the Study**

The Temporal: This study was conducted during the academic year 2019/2020.

The Spatial: The questionnaire, interviews and field visits were at the Faculty of Interior design at Philadelphia University.

The Epidermal: The study is limited to individuals of interior design in Philadelphia University.

The Scientific: The researcher was adopted in the selection of the dimensions of the indoor environment, which greatly affected the behavior and psychology of individuals, especially in residential places.

### **Research hypotheses**

1. Ho1: Providing good components for the internal environment of the house will have a positive impact on the behavior of its residents.
2. Ho2: The study of the integrated elements of the interior design would provide comfort, health, safety, welfare and privacy for its user.
3. Ho3: Indoor environmental quality affects productivity, performance and loyalty of the individual to his residences.

### **Research Methodology**

The methodology used in the research is the analytical descriptive method, which is based on a number of bases such as abstraction and generalization, and takes many forms such as theoretical or field survey. A statistical program (SPSS) was used after the collection of data through documents, publications, books, previous articles and the Internet. The questionnaires were distributed to members of the target group, including questions about the effect of the indoor environment of the places and to come up with the necessary recommendations. A number of field visits, interviews, taking pictures and taking notes during visits were also conducted.

A survey questionnaire was conducted for the study. The survey questionnaire was designed to evaluate the impact of design components on residential behavior, and it was divided into five categories (colors, lighting, furniture, ventilation and personal space), each category measures behavior levels of residences depending on variables (comfort, health, safety, welfare, and privacy). The questionnaire included the individual questionnaire and distributed 60 randomly selected questionnaires from interior design department at Philadelphia University. The questionnaire was presented to a number of indoor design specialists (four professors) to measure its content in terms of clarity, validity, and objectivity in the questions. Based on the results, the shortcomings were addressed. The form was amended and distributed to the specific sample members.

Interviews were also conducted with (10) randomly selected faculty members from interior design departments at several universities in Jordan. They were interviewed in their own offices and their answers to questions related to the subject were recorded.

The study depends on basic data from the target group. Also, it depends on other sources such as documents, publications, previous study, books related to the subject matter, references, indexes, previous articles related to the subject matter and network (internet) publications.

### **Research Sample**

A special questionnaire was designed for this study, and the questionnaire included a data form for the participants. 60 questionnaires were distributed to the participants randomly, and they were selected from Irbid city residents who own their own homes. The questionnaire was also presented to a number of interior design specialists to measure the content of the questionnaire in terms of clarity, truthfulness, and objectivity in the questions. Based on the results of this research, its deficiencies were addressed, amended, and distributed to the selected sample members. Personal interviews were also

conducted with (10) practicing academics from Jordan universities in the field of interior design, and they were interviewed by phone, and their answers to questions related to the topic were recorded. Also, during the field visits, some observations were recorded about the design of interior environments in homes that are currently available, and a number of pictures were taken for those places, with focus on studying colors, lighting, furniture, and space as measuring elements of the validity of the interior design of these houses.

#### **Validity & Reliability of research**

The results of the statistical analysis showed that the value of the Cronbach's alpha coefficient is high for each domain, as it ranged between (0.78-0.93), while all the items in the questionnaire reached (0.90). Likewise, the value of validity is high for each field, as it ranges between (0.8-0.92), while for every one the differences in the paragraphs of the questionnaire reached (0.91), which means the degree of reliability is high and statistically significant.

#### **Literature Review**

Alhorra, Y., Arif, M., Katafygiotou, M., Mazroei, A., Kaushik, A., and Elsarraga, E., (2016) in their study "Impact of indoor environmental quality on occupant well-being and comfort: A review of the literature" studied the lack of adoption of global measurements in the design of the interior spaces of housing within the limits of research samples, which reflect the lack of awareness of the requirements of special needs and the limits of their needs in modern housing. This study led to the submission of a number of recommendations, the most important of which is the need to pay attention to the scientific programs necessary to raise awareness of issues related to the life of the individual with special needs and to the interior design of the spaces in which the individual resident performs his daily activities, in addition to designing the indoor environment in such a way as to achieve the concept of sustainable environmental design. The study noted the inadequacy of most of the indoor spaces and their area and dimensions and the degree of movement of the disabled as well as the lack of aids such as wheelchairs facilitate the performance of various life events. Noted also was the use of inadequate furniture in furnishing housing in terms of height of furniture (chairs - tables - shelves - cabinets) for the movement of the body of the disabled in addition to unsuitable dimensions and heights of structural elements and designs: transitional doors and windows and corridors, slopes and gradients and lighting switches, and electricity and other equipment. The design of most of the interior spaces of the homes of family members with special needs was not considered as flexible design. Many buildings did not take into account the requirements of the sustainable design environment, whether by providing adequate space for the interior spaces or by providing the necessary inputs and furniture. All available furniture is intended for average individuals and the design's technical specifications of the houses were not specialized, but were also general and based on the expertise of technicians and without special requirements requested by the owner of the house or the head of the family. The simulation in the designs of the interior spaces was done without the technical treatments that serve the individual, thus resulting in a negative situation, neglecting important details because of the absence of perceptions and planning optimization before the start of construction and design.

Also, Ajimotokan, H. (2009) in his study "Influence of Indoor Environment on Health and Productivity" concluded that the indoor environment and its key components, organizational structure, organizational culture, and organizational resources, play an important and vital role in the performance of organizations by influencing the nature of the organizational climate that is reflected in the behavior of their employees. The environment conveys to the individual the principles, values and ideals that he follows and leads in his life and defines his relations with others. Collective perceptions of

individuals living and working in this environment and these characteristics have shown their impact on their behavior. A culture of quality is understood as a set of elements: shared values, beliefs, expectations and commitment to quality. The study aimed to reveal the existence of a relationship between the school environment and the achievement of the study and found the study to the absence of a relationship of statistical significance between the school environment and the academic achievement of pupils. Quality helps to improve the educational process. Inadequate furniture appeared to be used in the furnishing of housing in terms of height of furniture (chairs - tables - shelves - cabinets) for the movement of the body of the disabled. The quality of interior design of the buildings can be used to meet the needs and desires of the functional and aesthetic customers, and provide them with a valuable benefit from their point of view. All available furniture is intended for the average individuals and the design's technical specifications of the houses were not specialized, but were also general and based on the expertise of technicians and without special requirements requested by the owner of the house or the head of the family.

Sujanova, P., Rychtarikova, M., Mayor, T. and Hyder, A. (2019) in their study "A Healthy, Energy-Efficient and Comfortable Indoor Environment, a Review" found that there are significant differences of statistical significance between the views of engineers in terms of the impact of the quality of architectural design in achieving the competitive advantage of engineering companies by demographic variables (gender, age and job title). Also, there is a significant statistical impact of the quality of architectural design (good design of the interior spaces (utility) and the interest of design factors of the environment (durability), and aesthetic design. Quality is important among the things that we should seek when thinking about the design of a new product or the development of an old product. Competitors can be confronted by quality factor, projects and distinctive products. The quality of the interior design of the buildings can be used to meet the needs and desires of the functional and aesthetic customers, and provide them with a benefit of high value from their point of view. Design aesthetics is a major part of the dimensions of design quality (good design of interior spaces and environmental design interest). Safety can be provided through good design process. Quality in design is the most important step in sustainable design. The research achieved a relationship between quality and psychological comfort. The indoor environment and its key components, organizational structure, organizational culture, and organizational resources, play an important and vital role in the performance of organizations.

**Table 1: Results from previous researches and current research author opinion**

#	Content	1 <sup>st</sup> Study	2 <sup>nd</sup> Study	3 <sup>rd</sup> Study	Remarks
1	Behavior	- Awareness of the requirements - Special needs - Daily activities	- Organizational structure - Organizational culture - Organizational resources	- Significant of design - Quality of design - Design factors	- Innovation of Design - Needs of Individuals - Daily activities
2	Positive Behavior	- Raise awareness of behavior issues - Achieve the concept of sustainable design.	- Principles values - Principles ideals - Collective perceptions	- Utility environment - Durability environment	- Design quality - Performance quality - Environment quality
3	Comfort	- Performance of various life events. - Structural elements design - Good movement	- Relationship with others - A culture of quality environment	- Quality factor - Quality projects - Quality distinctive products.	- Flexible Mobility - Design elements - Environment quality
4	Well-being	-Flexible design - Necessary inputs	- Functional customer's desires	- Quality of design	- Function - Aesthetic

#	Content	1 <sup>st</sup> Study	2 <sup>nd</sup> Study	3 <sup>rd</sup> Study	Remarks
		- Technical specifications - Special requirements	- Aesthetic customers desires	- Design product - Design development	- development
5	Health	- Natural materials	- Organizational climate	- Quality in design - Sustainable design	- Design quality - Environment quality - Individuals performance
6	Safety	- Global measurements in design	- Commitment to quality	- Good design process	- Design Process - Building performance - Individuals perception
7	privacy	- Transitional doors and windows and corridors	- Individuals special requirements	- psychological issues	- Personal space - Design planning - Individuals requirements
8	Productivity And Loyalty	- Perceptions and planning optimization in design	- Organizations performance - Quality process improvement - Valuable benefit of design	- The quality of the interior design - The quality of buildings - Meet the needs and desires of users	- Design Value - Environment performance - Individuals feelings
9	Stability And Reassurance	- Requirements of the sustainable design environment	- Shared values - Shared beliefs - Shared expectations	- Good design quality - Vital role in design - Performance design	- Design Environment benefits - Individuals expectations
10	Colors	- Technical treatments	- Suitable colors in walls, floors, and ceilings	- Aesthetic colors	- Function - Aesthetic - Treatments
11	Lighting	- Gradients and lighting switches - Electrical equipment.	- Technicians lighting expertise	- Performance lighting design	- Function - Aesthetic - Treatments
12	Furniture	- Suitable furniture - Agronomy furniture - necessary furniture	- Good Furnishing - Technical furniture specifications	- Functional furniture - Aesthetic furniture	- Function - Aesthetic - Necessity
13	Ventilation	- Suitable doors, windows and openings	- Suitable spaces and openings	- organizational structure - organizational culture - organizational resources	- Openings - Space - resource
14	Personal space	- Suitable indoor spaces - Suitable dimensions - Adequate spaces	- Special personal requirements	- Good interior spaces - The dimensions of design	- Individuals Dimensions - Individuals personality - Individuals Activity

*Note: Remarks written by the current research author to show his opinion on each of the contents.*

Table (1) shows results of previous studies and the present research author's opinion about the effect of the quality of the components of the indoor environment on the behavior of individuals within their buildings as follows:

1. Behavior: The individual's behavior is affected by the elements of interior design in indoor environments. The first study shows that awareness of the environment, special needs, and daily activities are the main components that affect the behavior of individuals in their housing. As for the second study, it shows that the organizational structure, culture, and resources affect behavior significantly. The third study suggests that the

significance of design, the quality of the design, and other design factors are what affect behavior inside indoor environments. In my opinion as a researcher, the innovation of the design, daily activities and needs of individuals are what affect the individual's behavior the most.

2. Positive behavior: The positivity of the individual's behavior has proved to be affected by the elements of interior design as well. The first study shows that raising awareness of behavioral issues and achieving a concept of sustainable design affect behavior in a positive way. As for the second study, it shows that principle values, principle ideas and collective perceptions are what affect the behavior's positivity. The third study proves that the utility and durability of the environment also affect the positive behavior. In my opinion as a researcher, design quality as well as performance and environmental quality are factors which affect the individual's behavior positively.

3. Comfort: The comfort of individuals is one of the most important aspects affected by the elements of interior design. The first study suggests that the performance of various life events, the structural elements design and good movement are what affect the comfort of human beings the most. However, the second study shows that the relationships with other and the cultural quality of the design maintain the comfort of these individuals within their indoor environments. The third study also shows that the quality factors, quality projects, and quality distinctive products affect the level of comfort as well. In my opinion, flexible mobility, design elements and environment quality increase the comfort of individuals too.

4. Well-being: the well-being of each person in their housings is also impacted by the key elements of interior design, as the first study suggests that flexible design, necessary inputs, technical specifications and special requirements increase the well-being of each individual in their environment. The second study also shows that functional customer's desires and aesthetic customer's desires have a part in the individual's well-being. As for the last study, it proves that the quality of design, design products and design development influence the well-being in the environment.

5. Health: interior design elements play a part in the health of individuals in their environments. The first study says that natural materials form an important component in the health of individuals. As for the second study, it shows that organizational climate can also affect their health. Similarly, the last study implies that the quality in design and sustainability in design affect the individual's health. In my opinion, the design quality, environmental quality, and the individual's performance affect the health factor in these environments the most.

6. Safety: The interior design elements in indoor environments should be used accordingly to accelerate the safety and security in them. For the first study, the results imply that global measurements in design play an important part in maintaining the safety in the area. As for the second study, the commitment to quality is what modifies the safety and secures it. In the last study, results show that a good design process increases the safety as well. In my personal opinion, the design process, building performances and the individual's perception help to create a safe and protected environment.

7. Privacy: In interior design elements, privacy is considered a significant aspect, with the first study going to show that transitional doors, windows and corridors maintain and provide a private space for the individuals. Similarly, the second study also shows that individual's special requirements often influence the sense of privacy the person has. In the third study, however, working on psychological aspects and issues affects the privacy in these environments. In my opinion as a researcher, providing personal space, design planning, and individual requirements are the key factors in increasing the feeling of privacy for each individual.

8. Productivity and Loyalty: Productivity and loyalty stem from having good interior design elements and components. As shown in the first study, perceptions and planning optimization in design form loyalty as well as productivity in the air of the environment. The second study comes to show that the organization's performance, the quality process improvement, and the valuable benefits of design are what shape the sense of loyalty and productivity for the person. In the third and last study, the quality of the interior design, the quality of buildings, and meeting the needs and desires of each and every user also plays a part in loyalty and productivity in the environment. In my opinion as researcher, design value as well as environment performance and individual's feelings are what influence the productivity and loyalty for the individual.

9. Stability and Reassurance: The interior design's main elements affect the stability and reassurance levels for each individual in a positive manner as proven by three studies; the first study shows how requirements of the sustainable design environment are key factors to increasing both the reassurance and stability for each person. The second study shows that shared values, beliefs and expectations increase both the reassurance and stability for all individuals in homes. As for the third study, good design quality has a vital role in design and performance design for the stability of the individual as well as their reassurance. In my personal opinion, the design as well as environment benefits and individual's expectations increase the sense of stability and reassurance for individuals in their housing.

10. Colors: as for the rest of the components, colors are one of the primary elements related to interior design. In the first study, colors are used as technical treatments in design. Meanwhile, in the second study, suitable colors on walls, floors, and ceilings affect the quality of design in the built environment. As for the third study, the aesthetic of colors can improve individual behavior positively. In my opinion, colors play an important role in interior design through function, aesthetics, and treatments as well as experience.

11. Lighting: in any environment, lighting is essential for the productivity and overall atmosphere in the indoor environment. As the first study shows, gradients, lighting switches and electrical equipment can have an affect on one's experience in his/her housing. The second study shows that the technician's lighting expertise can heavily influence the performance of lights in these built environments and in return, the behavior of individuals. Lastly, the third study shows that the performance in lighting design impacts the behavior and perspective of individuals. In my opinion, through function, aesthetic and treatments, lighting is one of the main factors that affect interior design in built environments.

12. Furniture: as one of the main components in the elements, furniture is the ultimate base of interior design and the most important element of all, as the rest of the principles are decided and based off to fit the furniture. In the first study, it is proven that interior design inside built environments is affected by three main factors for furniture, those being suitable furniture, agronomy furniture and necessary furniture. As for the second study, it is shown how good furnishing and technical furniture specifications can impact and affect the quality of the design, as well as the individual's behavior. Likewise, in the third study, functional furniture and aesthetic furniture prove to be main aspects to keep in mind when choosing the suiting furniture for all kinds of indoor environments. In my opinion, the function, aesthetic and necessity of the furniture are key segments to keep in mind upon choosing suitable furniture.

13. Ventilation: Ventilation in interior design elements improves the quality of the environment surrounding individuals and keeps a safe and healthy area for all. The first study suggests that suitable doors, windows, and openings should be taken into consideration when designing indoor environments. The second study also emphasizes



the prominence of open spaces and suitable openings to improve ventilation as a whole in housing. As for the third study, it is shown that organizational structure, organizational culture and organizational resources all partake into providing sustainable and suitable ventilation for individuals inside built compounds. In my opinion as researcher, the openings, spaces and resources are all key elements required to provide ventilation in these environments.

14. Personal space: personal space is offering the free areas for individuals to express their daily activities in built environments. In the first study, suitable indoor spaces, suitable dimensions, and adequate spaces are all important to consider when designing indoor areas. However, in the second study, it is emphasized that special space requirements are main principles for personal space designs. In the third study, it was found that good interior spaces and the dimensions of design used in built environments all play a similar role in sustaining personal space for all. In my opinion, however, the individual's dimensions, personality, and activities are what help produce a free personal space for all individuals.

Finally, the literature review shows how interior design elements can improve indoor environment quality. Also, it shows the positive behavior impact of design elements (color, light, materials, furniture and personal spaces). Similarly, the literature review deduced that behavior is impacted through the human being's comfort, well-being, health, safety and privacy. Lastly, positive behavior impacts productivity, loyalty, stability, and reassurance of the individual within indoor environments.

### Research Results

Research data was done by distributing a survey to the individuals in their department and asking them to fill it and then were collected. Interviews were conducted after an appointment with them in their offices, and audio recording was used during the questioning and interviews. The data was dumped, encoded, and tabulated for statistical analysis. The notes were also unloaded in tables designed by the researcher. The results were analyzed through the abstraction of information in statistical tables to produce the final results of this research.

### First: Results of Questionnaire:

*Table 2: Analysis of the results of the questionnaire:*

No.	Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	Indoor environmental quality impacts individuals' behavior in their houses	35	18	3	1	3
2	Indoor environmental quality impacts individuals positively in their houses	35	15	6	1	3
3	Indoor environmental quality impacts individuals' comfort in their houses	19	30	4	3	4
4	Indoor environmental quality impacts individuals' well-being in their houses	27	20	5	3	5
5	Indoor environmental quality impacts individuals' health in their houses	26	22	4	2	6
6	Indoor environmental quality impacts individuals' safety in their houses	29	25	3	1	2
7	Indoor environmental quality impacts individuals' privacy in their houses	27	26	3	2	2
8	Indoor environmental quality impacts individuals' behavior in their houses, which increases their productivity and loyalty within their residences	24	25	5	5	1
9	Indoor environmental quality impacts individuals' behavior in their houses, which increases their stability and reassurance within their residences	23	29	3	1	3

No.	Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
10	Comfortable and calm colors increase levels of positive behavior for individuals in their residences	28	24	-	5	3
11	Comfortable and suitable lighting improves positive behavior of individuals	28	25	-	3	4
12	Comfortable and calm furniture increase levels of positive behavior for individuals in their residences	23	33	-	2	2
13	Good ventilation increase levels of positive behavior for individuals in their residences	29	20	4	2	5
14	Personal spaces increase levels of positive behavior for individuals in their residences	25	29	-	1	5

**Analysis of the results from questionnaire (see table: 2):**

The first result: 53-60 participants confirmed that indoor environmental quality impacts individuals’ behavior in their houses, while 4-60 participants confirmed the opposite, while 3-60 were neutral.

The second result: 50-60 participants confirmed that Indoor environmental quality impacts individuals positively in their houses, while 4-60 participants confirmed the opposite, while 6-60 were neutral.

The third result: 49-60 participants confirmed that indoor environmental quality impacts individuals’ comfort in their houses, while 7-60 participants confirmed the opposite, while 4-60 were neutral.

The fourth result: 47-60 participants confirmed that indoor environmental quality impacts individuals’ well-being in their houses, while 8-60 participants confirmed the opposite, while 5-60 were neutral.

The fifth result: 48-60 participants confirmed that indoor environmental quality impacts individuals’ health in their houses, while 8-60 participants confirmed the opposite, while 4-60 were neutral.

The sixth result: 54-60 participants confirmed that indoor environmental quality impacts individuals’ safety in their houses, while 3-60 participants confirmed the opposite, while 3-60 were neutral.

The seventh result: 53-60 participants confirmed that indoor environmental quality impacts individuals’ privacy in their houses, while 4-60 participants confirmed the opposite, while 3-60 were neutral.

The eighth result: 49-60 participants confirmed that indoor environmental quality impacts individuals’ behavior in their houses, which increases their productivity and loyalty within their residences, while 6-60 participants confirmed the opposite, while 5-60 were neutral.

The ninth result: 52-60 participants confirmed that indoor environmental quality impacts individuals’ behavior in their houses, which increases their stability and reassurance within their residences, while 4-60 participants confirmed the opposite, while 3-60 were neutral.

The tenth result: 52-60 participants confirmed that comfortable and calm colors increase levels of positive behavior for individuals in their residences, while 8-60 participants confirmed the opposite, while none were neutral.

The eleventh result: 53-60 participants confirmed that comfortable and suitable lighting improves positive behavior of individuals, while 7-60 participants confirmed the opposite, while none were neutral.

The twelfth result: 56-60 participants confirmed that comfortable and calm furniture increase levels of positive behavior for individuals in their residences, while 4-60

participants confirmed the opposite, while none were neutral.

The thirteenth result: 49-60 participants confirmed that good ventilation increase levels of positive behavior for individuals in their residences, while 7-60 participants confirmed the opposite, while 4-60 were neutral.

The fourteenth result: 54-60 participants confirmed that personal spaces increase levels of positive behavior for individuals in their residences, while 6-60 participants confirmed the opposite, while none were neutral.

### Third: Result of Interview:

Table 3: Interview Analysis Table:

No.	The question	Comfort	Well-being	Health	Safety	Privacy	Productivity & loyalty	stability & reassurance
1	In your opinion, do you think that indoor environmental quality impacts individuals' behavior in their houses? Is this impact positively or negatively? Explain that impacts on comfort, well-being, health, Safety, privacy, productivity, loyalty, stability and reassurance.	7.2	6.6	6.4	7.2	6	6	6.8
2	In your opinion, is there any relationship between the quality of the indoor environment and furniture in houses? What is the role of furniture in providing comfort, well-being, health, Safety, privacy, productivity, loyalty, stability and reassurance?	8	6	7	5	6	7	8
3	In your opinion, is there any relationship between the quality of the indoor environment and the lighting in houses? What impact did this have on comfort, well-being, health, safety, privacy, productivity, loyalty, stability and reassurance?	7	6	6	8	7	5	6
4	In your opinion, is there a relationship between the quality of the indoor environment and general ventilation standards in houses? What is the role of ventilation in achieving the comfort, well-being, health, safety, privacy, productivity, loyalty, stability and reassurance?	6	8	7	7	5	6	8
5	In your opinion, is there a role for colors in achieving the quality of the indoor environment in residences? What are the effects of color on comfort, well-being, health, safety, privacy, productivity, loyalty, stability and reassurance?	7	7	5	8	7	5	6
6	In your opinion, what is the role of personal space in achieving the quality of the indoor environment in houses? What are the effects of personal space on comfort, well-being, health, safety, privacy, productivity, loyalty, stability and reassurance?	8	6	7	8	5	7	6

### Interview Results (see table: 3):

The First result: Indoor environmental quality impacts individuals' behavior positively in their houses; it could increase levels of comfort (72%), well-being (66%), health (64%), Safety (72%), privacy (60%), productivity & loyalty (60%), and stability & reassurance (60%) of individuals in their houses.

The Second result: Furniture impacts individuals' behavior from indoor environmental design quality of environment in houses; it could increase levels of comfort (80%), well-being (60%), health (70%), Safety (50%), privacy (60%), productivity & loyalty (70%), and stability & reassurance (80%) of individuals in their houses.

The Third result: Lighting impacts individuals' behavior from indoor environmental design quality of environment in houses; it could increase levels of comfort (70%), well-being (60%), health (60%), Safety (80%), privacy (70%), productivity & loyalty (50%), and stability & reassurance (60%) of individuals in their houses.

The Fourth result: Ventilation impacts individuals' behavior from indoor environmental design quality of environment in houses; it could increase levels of comfort (60%), well-being (80%), health (70%), Safety (70%), privacy (50%), productivity & loyalty (60%), and stability & reassurance (80%) of individuals in their houses.

The Fifth result: Color impacts individuals' behavior from indoor environmental design quality of environment in houses; it could increase levels of comfort (70%), well-being (70%), health (50%), Safety (80%), privacy (70%), productivity & loyalty (50%), and stability & reassurance (60%) of individuals in their houses.

The Sixth result: Personal space impacts individuals' behavior from indoor environmental design quality of environment in houses; it could increase levels of comfort (80%), well-being (60%), health (70%), Safety (80%), privacy (50%), productivity & loyalty (70%), and stability & reassurance (60%) of individuals in their houses.

### Research Findings

**Table 4: Research final findings:**

No	The Result	Questionnaire	Interviews
1	Indoor environmental quality impacts individuals' behavior in their houses	88%	66%
2	Indoor environmental quality impacts individuals positively in their houses	83%	66%
3	Indoor environmental quality impacts individuals' comfort in their houses	81%	72%
4	Indoor environmental quality impacts individuals' well-being in their houses	78%	66%
5	Indoor environmental quality impacts individuals' health in their houses	80%	64%
6	Indoor environmental quality impacts individuals' safety in their houses	90%	72%
7	Indoor environmental quality impacts individuals' privacy in their houses	83%	60%
8	Indoor environmental quality impacts individuals' behavior in their houses, which increases their productivity and loyalty within their residences	81%	60%
9	Indoor environmental quality impacts individuals' behavior in their houses, which increases their stability and reassurance within their residences	86%	68%
10	Comfortable and calm colors increase levels of positive behavior for individuals in their residences	86%	64%
11	Comfortable and suitable lighting improves positive behavior of individuals	88%	64%
12	Comfortable and calm furniture increase levels of positive behavior for individuals in their residences	93%	67%
13	Good ventilation increase levels of positive behavior for individuals in their residences	81%	67%
14	Personal spaces increase levels of positive behavior for individuals in their residences	90%	67%

#### **Analysis of the research findings (see table: 4):**

The first finding: The quality of the indoor environment affects the behavior of individuals in their houses. This was confirmed by the results of the questionnaire, as 88% of the specialists confirmed this. This was confirmed by the results of the interviews with 66% Specialists. In my opinion, indoor environmental quality impacts individuals' behavior in their houses.

The second finding: The quality of the indoor environment affects the behavior of individuals positively in their housing. This is confirmed by the results of the questionnaire, as 83% of the specialists confirmed this, as confirmed by the results of interviews from the opinions of specialists 66%. In my opinion, indoor environmental quality impacts individuals positively in their houses.

The third finding: The quality of the indoor environment affects individuals' comfort in their homes, as confirmed by the results of the questionnaire, as 81% of the specialists confirmed this, as confirmed by the results of interviews, where 72% of the opinions Specialists. In my opinion, indoor environmental quality impacts individuals' comfort in their houses.

The fourth finding: The quality of the indoor environment affects individuals' well-being of within their homes. This is confirmed by the results of the questionnaire, as 78% of the specialists confirmed this, as confirmed by the results of the interviews, where 66%. In my opinion, indoor environmental quality impacts individuals in their houses. In my opinion, indoor environmental quality impacts individuals' well-being in their houses.

The fifth finding: The quality of the indoor environment affects the health of the individuals inside their homes. This is confirmed by the results of the questionnaire, as 80% of the specialists confirmed this, as confirmed by the results of the interviews, where 64%. In my opinion, indoor environmental quality impacts individuals' health in their houses.

The sixth finding: The quality of the indoor environment affects the safety of individuals within their homes. This is confirmed by the results of the questionnaire, as 90% of the specialists confirmed this. This was confirmed by the results of the interviews, where 72%.

In my opinion, indoor environmental quality impacts individuals' safety in their houses.

The Seventh finding: The quality of the indoor environment affects the privacy of individuals within their homes. This is confirmed by the results of the questionnaire, as 88% of the specialists confirmed this. This was confirmed by the results of the interviews, where 60%. In my opinion, indoor environmental quality impacts individuals' privacy in their houses.

The Eighth finding: The quality of the indoor environment affects individuals' behavior in their houses, which increases their productivity and loyalty within their residences. This was confirmed by the results of the questionnaire, where the percentage reached 81%. This was confirmed by the results of the interviews, which reached 60% Field. In my opinion, indoor environmental quality impacts individuals' productivity and loyalty in their houses.

The ninth finding: The quality of the indoor environment affects individuals' behavior in their houses, which increases their stability and reassurance within their residences, as confirmed by the results of the questionnaire, where the percentage was 86%, as confirmed by the results of interviews, where the percentage was 78%. In my opinion, indoor environmental quality impacts individuals' stability and reassurance in their houses.

The Tenth finding: Comfortable and calm colors increase levels of positive behavior for individuals in their residences, as confirmed by the results of the questionnaire, where the percentage was 86%, as confirmed by the results of the interviews, where the rate was 64%. In my opinion, comfortable and calm colors increase levels of positive behavior for individuals in their residences.

The Eleventh finding: Comfortable and suitable lighting improves positive behavior of individuals, as confirmed by the results of the questionnaire, where the percentage was

88%, as confirmed by the results of the interviews, where the rate was 64%. In my opinion, comfortable and suitable lighting improves positive behavior of individuals.

The Twelfth finding: Comfortable and calm furniture increases levels of positive behavior for individuals in their residences, as confirmed by the results of the questionnaire, where the percentage was 93%, as confirmed by the results of the interviews, where the rate was 67%. In my opinion, comfortable and calm furniture increase levels of positive behavior for individuals in their residences.

The Thirteenth finding: Good ventilation increases levels of positive behavior for individuals in their residences, as confirmed by the results of the questionnaire, where the percentage was 81%, as confirmed by the results of the interviews, where the rate was 67%. In my opinion, good ventilation increase levels of positive behavior for individuals in their residences.

The Fourteenth finding: Personal spaces increase levels of positive behavior for individuals in their residences, as confirmed by the results of the questionnaire, where the percentage was 90%, as confirmed by the results of the interviews, where the rate was 67%. In my opinion, personal spaces increase levels of positive behavior for individuals in their residences.

Finally, interior designers must take care of indoor quality during the designing process by providing comfort, welfare, health, safety, and privacy to reach high levels of individuals' behavior. They can achieve comfort issue by using comfortable colors, materials, and furniture (see Figure: 1-5):



*Figure 1: Designing bedroom with comfortability issue by using colors, materials and furniture.*



*Figure 2: Designing living room with welfare issue by using furniture, accessories, open spaces for accessibility and mobility. Retrieved from google images in 2019. ),*



*Figure 3: Designing family room with welfare issue by using heathy furniture, colors, lighting and personality. Retrieved from google images in 2019. )*



*Figure 4: Designing living room with safety issue by using natural and artificial lighting design. Retrieved from google images in 2019.)*



*Figure 5: Designing master bedroom with privacy issue by suitable personal spaces, colors, lighting and levels. Retrieved from google images in 2019.*

## Conclusion

In this research, the findings revealed that indoor environmental quality impacts individuals' behavior positively in their houses. Using comfortable and calm colors increases levels of comfort, luxury, and health of individuals, which reflects positively on their behavior, productivity, and loyalty within their housing. Using comfortable and suitable lighting improves the positive behavior of individuals in their interior residences, which, in turn impacts their daily activities. Using comfortable and suitable furniture provides satisfaction and reassurance for individuals in their residences. Good ventilation creates an environment that is safe, healthy, and free from diseases by eliminating moisture, mold, bacteria, insects, and different pollutants, which makes the resident feel psychologically positive, reflecting positively on behavior inside the house. Finally, customizing suitable personal spaces for individuals inside the house increases levels of privacy and this results in positive behavior during daily activities.

#### **Recommendations**

1. Cultural, traditional, and custom issues should be taken into account during the design process in residential buildings.
2. Interior designers should take care of the indoor environmental quality and its impacts on residential behaviors in an innovative way.
3. Evidence-based design must be included more to reach high levels of interior environmental design.
4. Field surveys should take into account the technical needs of indoor environmental quality for individuals before designing to solve all design problems in interior environments.
5. Evaluating indoor environmental quality continuously can help in reaching sustainability in home design.
6. In order to provide both individuals' high behavior through design, more research and studies of indoor environmental quality in residential applications must be conducted.
7. The researcher recommends conducting applied studies to provide the best design solutions for the interior environment of interior design in order to obtain the greatest benefit from it.

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