

## ENERGY EFFICIENCY: A CHANNEL TOWARDS ESTABLISHING SUSTAINABLE INTERIORS

<sup>1</sup>Dr. Mona Mehta and <sup>2,\*</sup>Ms. Alefiya. S. Lokhandwala

<sup>1</sup>Assistant Professor, Department of Family and Community, Resource Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda,, Vadodara, Gujarat, India

<sup>2</sup>Research Scholar, Department of Family and Community Resource, Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India

### ARTICLE INFO

#### Article History:

Received 18<sup>th</sup> April, 2018  
Received in revised form  
21<sup>st</sup> May, 2018  
Accepted 06<sup>th</sup> June, 2018  
Published online 30<sup>th</sup> July, 2018

#### Key Words:

Energy efficiency,  
Sustainability,  
Interior Design.

### ABSTRACT

The growing trends in population as well as building and construction sector in recent years has an immense impact on environment as well as quality of life, which has led to issues related integrally with increased demand on natural resources. As the building and construction sector is growing rapidly, preserving the environment poses host of challenges. The built-in environment of existing residential as well commercial establishments can create a sizeable impact on the global environment as well as of the occupants. Hence, there is a need to design interiors which minimizes the issues related to environment deterioration as well as impaired quality of life of the occupants. This augurs well for the country and now there is imminent need to introduce sustainable concepts, techniques in the building and construction sector, which can direct the growth in ecological manner. In wake of increase in natural and man-made disasters, it is sustainable interiors which play a marginal but critical role towards averting major ecological crisis. Various designers around the world have started their practices which contribute towards a healthy environment along with well-being of the occupants, as there is paradigm shift from 'environmentally irresponsible' to 'environmentally responsible' design. Sustainable interiors remarkably lead to energy efficient indoor spaces along with water efficient spaces with better indoor environment quality. It leads to an approach for reducing the energy cost by installation of energy efficient appliances and those certified by the star rating. By utilization of passive design strategies such as daylight, thermal mass, and shading there is significant reduction in energy demands which reduces the required energy costs. The major purpose of the study was to identify the practices of selected Interior designers which lead to energy efficient indoor spaces while designing Sustainable Interiors. The study was conducted among sixty practicing Interior designers from Ahmedabad city, who were chosen on the basis of purposive and snowball sampling technique. The findings of the study revealed that majority of the respondents very often followed the practices which lead to energy efficient indoor spaces, which in all led towards achieving the aim of sustainable interiors. The findings of the present research would be beneficial to educational institutions, government and non-government organizations, practicing architects, and Interior designers to meet the challenges as well as popularize the concept of Sustainable Interior Design.

Copyright © 2018, Mona Mehta and Alefiya .S. Lokhandwala. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Dr. Mona Mehta and Ms. Alefiya .S. Lokhandwala, 2018. "Energy efficiency: A channel towards establishing Sustainable Interiors", International Journal of Development Research, 8, (07), 21970-21976.

## INTRODUCTION

Globalization and increasing industrialization, is leading towards depletion of natural resources – including forests, fossil fuels and other resources faster than they can be replaced, creating an unsustainable situation. The issues of climate change, diminishing resources and biodiversity, energy and water scarcity are reaching crisis point and are rightly, a major topical issue.

\*Corresponding author: Ms. Alefiya. S. Lokhandwala, Research Scholar, Department of Family and Community Resource, Management, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat, India.

All of these issues have been compounded by population growth, magnifying human impact on the planet, and will have disastrous consequences if they remain unchecked. The traditional practice of building construction as well as Interior design use more of natural resources which leads to irreversible damage to the environment which also inheritably effects the health of the occupants. Sustainable built environments are vital to the overall environmental sustainability effort (Brick and Frostell, 2007). Officially, the profession of interior design is one that promotes sustainability. It directly aims towards an integrated environmental friendly approach which houses for sustainable

interiors, grounded with the principles of meeting environmental as well as human needs sustainably. Sustainable development was first defined in 1987 in a report written during The Brundtland Commission of the United Nations as:

“Development that meets the needs of the present without compromising the ability of future generations to meet their own need.” (Winchip, 2007). In other words, a sustainable development should do its best to create less of an impact on the environment as well as sustain natural resources. From sustainable development comes the idea of sustainable design. Winchip (2007), in her book *Sustainable Design for Interior* defines sustainable design as. “Design that reflects a respectful interaction between people and the earth by conserving resources for current and future generations.”

In a broad sense, sustainability involves a long-term balance between environmental, economic, and social issues (Kang, 2004). Prior to the industrial revolution, most buildings and manufacturing processes were sustainable as they used local, usually renewable, materials and did not rely on fossil fuels for material or production. Since the nineteenth century, however, technological advances have allowed the industrialized world to rely heavily on low-cost, inefficient building and manufacturing techniques that have often proven to be environmentally irresponsible (Berman, 2008). Although Sustainable Interior Design is being a major issue in the Interior design practice, there are very few resources which aids an Interior designer to pursue the same, which has resulted to “Sustainable gap”, acknowledging the disparity which exists between the principles of Sustainable Interior Design and the reality of practice. Even though now society has begun to recognize the interconnectedness of buildings, people and community in the creation of sustainable built-in environment. The clients and Interior designers are trying to understand their role and impact on the environment. As a result the interest in environmental responsibility is what that has sparked the context and need of Sustainable Interior Design.

Sustainable design is an inherent part of good design (Moxon, 2012). It is one which incorporates the aspects such as water efficiency, energy efficiency, use of sustainable materials and enhancement of indoor environment quality which has both positive impacts on environment as well as on health of occupants. It has been observed that sustainable design in traditional, vernacular buildings around the world reflects the practices of sustainable design. These typically showcase the basic practices of using local, natural materials, simple construction methods local skills along with exploring its passive design principles. In passive design, the form, orientation and integral layout of the building are used to derive energy from the sun, daylight, and wind. Reducing energy use in the interiors is therefore a sensible and responsible starting point for the sustainable interior designer (Moxon, 2012). Energy both that is used to run a completed interior and that embedded in products namely; solar equipments, star rated equipments, etc. which has greatest effect, being the main source of global carbon emissions. Initially to reduce the energy demands in the built in space, passive design approach should be considered, thereafter the energy-efficient equipments and products which are needed should be selected, and lastly the remaining energy demands should be taken care off with the renewable sources.

Various researches have also enlightened that many sustainable design solutions in context to energy efficiency do not require additional technology or cost, as they simply reuse design solutions that were commonly used in the past, such as proper citing for passive solar heating, outdoor air exchange, or daylighting (Farzam and Todesco, 2010). Certain energy efficient design decisions, such as proper solar orientation, do not have to be comparably expensive or technologically advanced if made during the early stages of design development (Horsley, et.al., 2003). Adaptive reuse and sustainable remodeling are another way to protect the environment and often cost far less than new construction (Pile, 1995). And designing for air-tightness can improve energy efficiency greatly, even reducing or eliminating the need for air conditioning in mild climates. Despite this, the issue of air-tightness was not found to have been requested, or even discussed, in all but a few projects in a post-occupancy study focused on sustainable buildings (Bordass, et.al., 2001). Sustainable design practices can also save money in other capital cost areas, such as reducing the expected Heating, Ventilation, and Air Conditioning (HVAC) loads far enough so that a smaller, and less costly, Heating Ventilation and Air Conditioning (HVAC) system than would otherwise be needed can be installed (U.S. Green Building Council, 2002, p. 5).

Apart from these the interiors should be designed in such a way that it makes way for sufficient daylight through doors and windows. The depth of the room and amount of daylight penetration through other transparent materials, can be modified to optimize natural daylighting, reducing the need for artificial lighting. It makes way for sufficient daylight through doors and windows. Additionally, while the direct effects of daylight on productivity can be difficult to quantify, there is empirical evidence that increased daylighting can lower energy bills in commercial buildings (McDougall, et.al., 2006). Moreover, using transparent, translucent or reflective materials indoors increases penetration of daylight within the interiors. Further, an interior can be planned so that work space and other areas needing most light are located near windows or roof lights.

To achieve the energy efficient indoor spaces, the equipments such as ceiling fans, electric geysers, refrigerators, television, washing machines etc. should be with the minimum 4 star rating from BEE (Bureau of Energy Efficiency). For artificial lighting, Compact Fluorescent Lamps (CFL) and Light Emitting Diode (LED) provides good energy efficient lighting which uses less electrical energy. They are long lasting, durable, cool mercury free and cost effective which can easily be replaced with the former incandescent lamps. T5 is most efficient one in the latest and best tube light available in the market currently. To complement and achieve high standards of energy efficiency in interiors solar energy, a renewable source is also often incorporated by the designers. It helps reducing reduce our carbon footprint and save per month on electricity bills. Photovoltaic cells and solar panels, harness sunlight, and transforms into energy by passing it to the inverters which converts it into the electricity to generate power in our residences. Solar lights, solar cookers, solar heaters etc. can also be installed for using maximum solar energy which reduces electric energy consumption Installation of high performance glasses leads to lower the amount of heat flow through windows and doors, by reflecting radiation rather than absorbing it.

It aids in reflecting the unwanted heat and preventing it from radiating it outside in winters, which also helps in providing thermal as well as acoustic insulation. Tinted glass reduces outside glare, minimizing fading to furnishing by Ultra- Violet (UV) rays and decreases the solar heat gain, hence addressing energy efficiency of the built in space. Moreover, sustainable interior design practices also takes consideration for creating energy as well as water efficient indoor space, encourage use of sustainable interior materials which all in all increases the indoor environment quality. Therefore, the objective of the study was to study various practices adopted for practicing Sustainable Interior Design by the respondents from the Ahmedabad city.

### Objectives of the study

- To study the demographic characteristics of practicing Interior designers from Ahmedabad city.
- To asses various aspects of Sustainable Interior Design followed by the practicing Interior designers from Ahmedabad city.
- To find out various energy efficient practices adopted by practicing interior designers for establishing sustainable interiors.

### Hypotheses of the study

- There exists an association between the selected personal and situational variables of the respondents with frequency of practicing energy efficiency while following Sustainable Interior Design.

## MATERIALS AND METHODS

The research design for the present investigation was descriptive in nature conducted on 60 practicing Interior designers selected purposively from Ahmedabad city of Gujarat state. The tool to collect data was questionnaire which contained a summated rating scale to find out various practices adopted by interior designers to practice Sustainable Interior Design. The responses on the scale of practices were subjected to scores. The practices were classified according to the aspects of Sustainable Interior Design which were 'Energy efficiency', 'Water efficiency', use of 'Sustainable Interior Materials', and 'Indoor Environment Quality'. It had 3 point continuum for the responses which were in terms of 'All of the projects', 'Some of the projects', and 'Few of the projects', which were further interpreted as practices followed 'Very often', 'Sometimes' and 'Rarely'. Scores of 3 through 1 were attributed respectively to the responses which reflected the Sustainable Interior Design Practices followed by the Interior designer in their respective projects. The scale was subjected to establishment of content validity and reliability. The tool prepared was validated from a panel of 11 experts from different departments, faculty and the Universities. The reliability coefficient derived for the scale was 0.89. To analyse relationship between selected variables Coefficient of correlation, and 't'-test, and were computed.

### Major Findings

#### Personal variables of the respondents

**Background information of the Interior designers from Ahmedabad city:** This section deals with personal

information regarding selected Interior designers of Ahmedabad city. It contains information regarding their age, gender and Educational qualification.

**Age and gender of the respondents:** The findings revealed that nearly one-half (48.3%) of the respondents were in the age group of 31 – 41 years. Very few of the respondents i.e. 16.7 percent were from the age group of 21 – 30 years. The minimum age of the respondent was found to be 23 years while the maximum age was 53 years. The mean age of the respondents was found to be 38.27 years. The findings further also highlighted majority i.e. 71.7 percent of the respondents were male and remaining i.e. 28.3 percent of the respondents were female. (Fig.: 1)

**(Educational qualification:** The data pertaining to the educational qualification of respondents, revealed that slightly more than one-third (35%) of respondents were holding Bachelor's degree in Interior design, whereas very few (15%) of the respondents had done their Master's degree in Interior design. Moreover, less than one-fourth (20%) of respondents had done their diploma in Interior design and remaining of them had their qualification in the field of architecture and civil engineering (B.Arch., B.E. Civil).

**Situational variables of the respondents:** It contains information regarding their work experiences, kinds of projects undertaken by them and sources of information through which they were informed about the Sustainable Interior Design.

**Duration of time working as an Interior designer:** The findings revealed that around one-third of the respondents (33%) had been working since 16 years and more in field of Interior design, little less than one-fourth (23.3%) of respondents had been working since 11 – 15 years, slightly more than one-fourth (26.67%) of respondents had been working since 06-10 years while very few of them i.e. 16.67 percent had work experience of less than 5 years.

**Number and kinds of Interior design projects undertaken by the respondents:** The findings analyzed that more than one-half (55%) of the respondents had taken up commercial projects ranging from 01 – 25 in number. One-fourth of the respondents (25%) had taken up more than 50 commercial projects. Moreover it was also revealed that less than one-fourth (20%) had taken up commercial projects ranging from 26 - 50 in number.

**Findings related to various aspects of Sustainable Interior Design Practices followed by the practicing Interior designers from Ahmedabad city:** The findings described various practices followed by the Interior in adopting Sustainable Interior Design in their practice. These practices were categorized into four sub aspects viz. 'Energy efficiency', 'Water efficiency', 'Sustainable Interior Materials' and 'Indoor Environment Quality'. The responses were sought in terms of 'All the projects', 'Some of the projects' and 'Few projects'. Furthermore, the responses were interpreted as the practices were adopted 'Very Often', 'Sometimes' and 'Rarely', which were ascribed the scores of 3 through 1. The computed weighted mean for each practice adopted while practicing Sustainable Interior Design revealed that practices related to 'Energy Efficiency' were practiced very often by Interior designers of Ahmedabad city to establish sustainable interiors. (Fig.: 4).

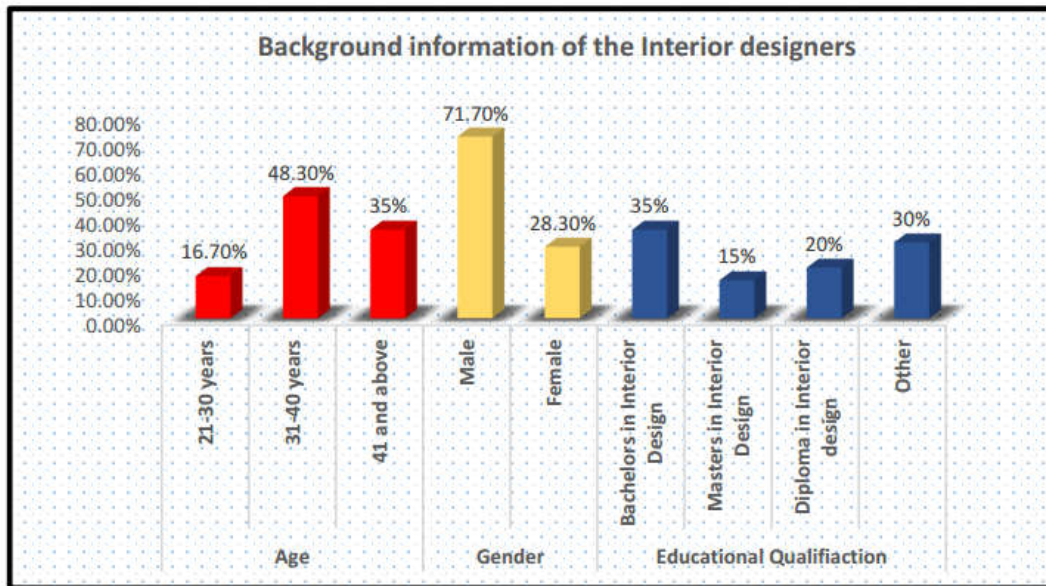


Figure 1. Distribution of respondents according their background information

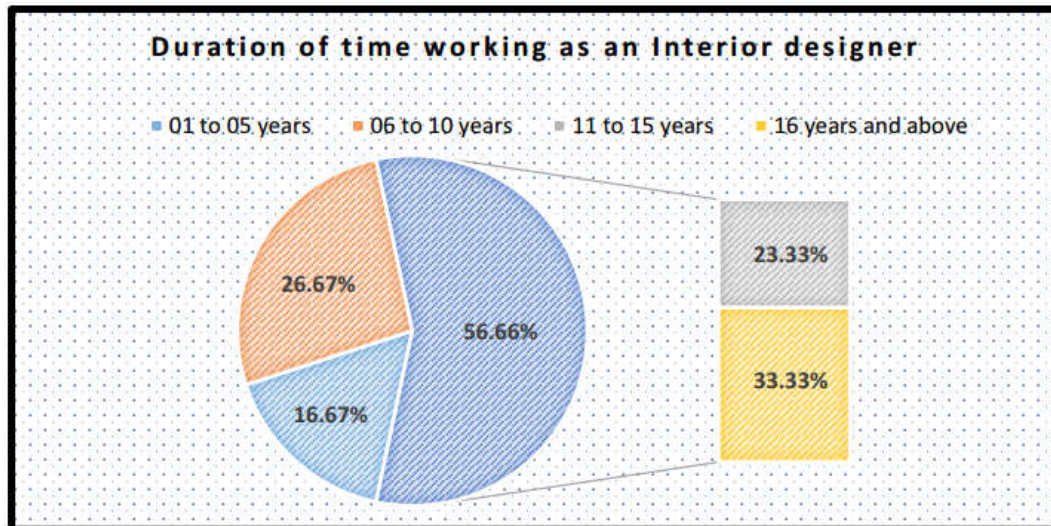


Figure 2. Distribution of respondents according their duration of time working as an Interior designer

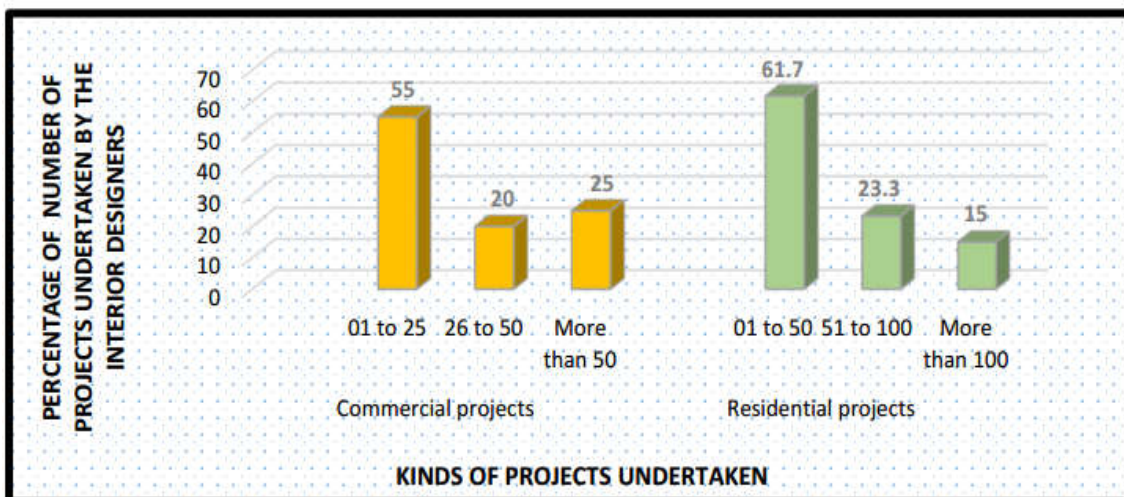


Figure 3. Distribution of respondents according to number and kinds of Interior design projects undertaken



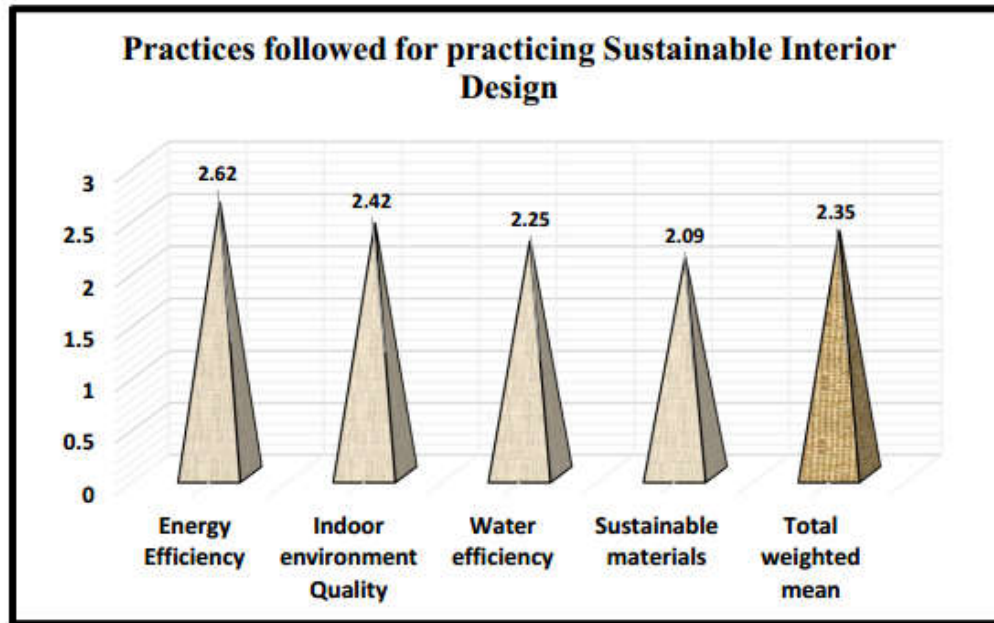


Figure 4. Distribution of respondents according to various practices adopted for practicing sustainable interior design

Table 1. Frequency and percentage distribution of respondents according to their energy efficient practices adopted for practicing Sustainable Interior Design

Sr. No.	Energy efficiency	Respondents (n=60)						Weighted Mean (1-3)
		Very Often		Sometimes		Rarely		
		f	%	f	%	f	%	
1.	Making the most of daylight to reduce the need for artificial lighting.	51	85.0	08	13.3	01	01.7	2.83
2.	Use of reflective louvers to control daylight and shading which increase illumination.	26	43.3	24	40.0	10	16.7	2.27
3.	Incorporation of photovoltaic cells to meet the electricity needs.	10	16.7	31	51.7	19	31.7	1.85
4.	Installation of equipments which runs through solar energy eg: solar lights, solar heaters, solar cookers, etc.	15	25.0	24	40.0	21	35.0	1.90
5.	Use of T5, T8, CFL's and LED light fixtures which have low energy consumption.	50	83.3	06	10.0	04	06.7	2.77
6.	Installation of energy efficient equipments which have energy efficient star ratings.	38	63.3	18	30.0	04	06.7	2.57
7.	Installation of electronic ballasts which increases the life of the light fixture.	23	38.3	31	51.7	06	10.0	2.28
8.	Installation of light meters.	21	35.0	18	30.0	21	35.0	2.50
9.	Use of LED's and optics which are sensor based.	11	18.3	30	50.0	19	31.7	1.87
10.	Installation of CFC free equipments.	18	30.0	27	45.0	15	25.0	2.55
<b>Total weighted mean</b>								<b>2.62</b>

**Table 2. Coefficient of correlation showing relationship between frequency of practicing Sustainable Interior Design and selected personal and situational variables of the respondents**

Variables	r-value	Level of Significance
<b>Personal Variables</b>		
Age (in years)	-0.12	N.S.*
Educational Qualification	0.21	N.S.*
Years of Work Experience	0.26	0.05
Number of projects undertaken (Residential)	0.01	N.S.*
Number of projects undertaken (Commercial)	-0.08	N.S.*
Number of projects undertaken with aspects of Sustainable Interiors (Residential)	0.14	N.S.*
Number of projects undertaken with aspects of Sustainable Interiors (Commercial)	0.07	N.S.*
<b>Situational Variables</b>		
Kinds of Projects undertaken	-0.01	N.S.*

Key: \*N.S. = Not Significant

### Findings related to Energy efficient practices adopted to establish Sustainable

**Interiors:** The findings highlighted in Table 1, depicts the data regarding the energy efficient practices adopted by practicing interior designers from Ahmedabad city to establish sustainable interior design. It was reported that, majority (80%) of the respondents very often made use of the daylight to reduce the need of artificial lights, along with which the respondents used the energy efficient equipments like T5, T8, CFL's and LED which led to low energy consumption. The findings further highlighted that energy efficient equipments with energy efficient star ratings were installed in all the projects undertaken by little less than one-third (63.3%) of the respondents. Moreover, little more than one-half (51.7%) of the respondents sometimes incorporated the practice of installing photovoltaic cells to meet the electricity needs of the occupants as well as similar percent of respondents implemented installation of electronic ballast which leads to increase the life of a light fixture, therefore enhancing the energy efficiency of the space. Furthermore, the findings also reflected that installation of equipments which runs through solar energy eg: solar lights, solar heaters, solar cookers, etc. was practiced rarely by less than one-third (35%) of the respondents which leads to energy efficient interiors.

**Testing of Hypotheses:** Coefficient of correlation and 't' test were computed to analyse the findings statistically, of the the hypotheses of the study, stated below :

**HO1:** There is no association between the selected personal variables namely (Age (in years), gender, educational qualification, years of work experience, ownership of firm and number of projects undertaken) and situational variables (Kinds of projects undertaken) of the respondents with frequency of following Sustainable Interior Design Practices.

To illustrate the results pertaining to the above mentioned null hypotheses which states that there exists no association between frequency of practicing Sustainable Interior Design with the selected personal variables namely; Age (in years), gender, educational qualification, years of work experience, ownership of firm, registration of the firm and number of projects undertaken by the respondents and situational variable such as kinds of projects undertaken. Coefficient of correlation, and 't' tests were used to attain the results statistically.

The results revealed significant positive relationship between frequency of practicing Sustainable Interior Design and work experience of the respondents at 0.05 level. The attained results reflected that the respondents who had more experience and educational qualification, had good hands in practicing the sustainable interiors which led to establish energy efficient indoor spaces. However, the other selected personal and situational variables did not reveal any significant association with the frequency of Sustainable Interior Design practices adopted by the respondents. Thus, the null hypotheses was partially accepted.

### Conclusion and Implication

Interior designers are professionals who are responsible for the design of homes, workplaces and public buildings. The sustainability of interiors is closely linked to environmental construction and building design efficiency. The ability to design well is the ability to solve the problem. Sustainable Interior Design Practices can be easily implemented in various commercial and residential establishments by following the suitable guidelines. When new interiors are to be done they can be easily molded to Sustainable Interiors by adopting certain practices, and renovating the existing interior through a simple process. It takes learning the techniques of Sustainable Interiors, knowledge of materials and equipments available in the market and going through list of what is feasible for ones own project which leads to smooth flow of practicing Sustainable Interiors. Many a times, the initial cost of adopting sustainable strategies may be equal or may surpass the cost in comparison to conventional practices. But in the long run it pays back through reduction in energy and water costs (bills), and enhancement of health and well being of the occupants. Sustainable Interiors, aids in creating the shell through which a more safer, energy efficient interior space with enhanced indoor environment quality is built which has positive impacts on the health and well being of the occupants as well as on the environment. Interior designer plays a role of important piece in the sustainability puzzle, and aids in protecting the environment. At local level, one should try to adopt the same so that we can have a cumulative sustainable environment approach globally, which will make the earth a better place to live in. Based on the findings of the present study, it can be concluded that energy efficiency plays an important role in establishing sustainable interiors. Moreover, along with practicing other aspects of sustainable interior design the problems related to environment and human well-being can be very well mitigated.

**REFERENCES**

- Berman, A. 2008. *Green Design: A Healthy Home Handbook*. London: Frances Lincoln Publications Limited.
- Bordass, B., Cohen, R., Standeven, M., and Leaman, A. 2001. *Assessing building performance in use 2: Technical performance of the Probe buildings*. Building Research and Information 29(2), 103-113.
- Brick, K., and Frostell, B. 2007. *A comparative study of two Swedish-based tools for practical environmental evaluation of buildings*. Journal of Environmental Assessment Policy and Management, 9(3), 319-339.
- Farzam, S., and Todesco, G. 2010. *Sustainability in cold climates*. ASHRAE Journal, 52(1), 20-28.
- Horsley, A., France, C., and Quartermass, B. 2003. *Delivering energy efficient buildings: A design procedure to demonstrate environmental and economic benefits*. Journal of Construction Management and Economics, 21, 345356.
- Kang, M., 2004. *The analysis of environmentally sustainable interior design practice*.
- McDougall, T., Nordmeyer, K., and Klaassen, C. J. 2006. *Low-energy building case study: IAMU office and training headquarters*. ASHRAE Transactions, 112(1), 312-320.
- Moxon, S. 2012. *Sustainability in Interior Design*. London: Laurence King Publication.
- Pile, J. 1995. *Interior Design (Second Edition)*. New York: Harry N. Abrams, Inc. U.S. Green Building Council, 2002. Building Momentum. Retrieved October 4, 2010 from: <http://www.asid.org/NR/rdonlyres/41D8F661-EF76-4061-BFD22980665B4C18/0/BuildingMomentum.pdf>. Unpublished Doctoral Dissertation, University of Minnesota, United States.
- Winchip, S. 2007. *Sustainable Design for Interior Environments (Second Edition)*. New York: Fairchild publications.

\*\*\*\*\*