

The State of Environmentally Sustainable Interior Design Practice

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Abstract: Problem statement: Research that investigates how interior designers use environmentally sustainable interior design criteria in their design solutions has not been done. To provide a base to develop education strategies for sustainable interior design, this study examined the state of environmentally sustainable interior design practice. **Approach:** A national, Internet-based survey of interior design practitioners was conducted. To collect data, the random sample of US interior design practitioners was drawn from the American Society of Interior Designers membership list. Environmentally sustainable interior design practice was defined by three factors: Global sustainable interior design, indoor environmental quality and interior materials. For each statement about environmentally sustainable interior design practice, respondents were asked to rate three dimensions: frequency of application, importance to the designer's firm and importance to the designer. Descriptive statistical analysis focused on the state of environmentally sustainable interior design practice. **Results:** Every statement to measure environmentally sustainable interior design practice showed the highest mean score in the category of importance to the designer and the lowest mean score in the category of frequency of application. Important to designer's firm ratings were always between these two extremes. Use of sustainable interior materials was identified as a less frequently applied component of environmentally sustainable interior design than indoor environmental quality. **Conclusion/Recommendations:** The application of environmentally sustainable interior design practice did not reach the same level as its perceived importance. Teaching methods that improve environmentally sustainable interior design practice and an understanding of the life cycle impact of interior materials are needed.

Key words: Sustainability, sustainable interior design, interior design practice

INTRODUCTION

Interior designers are beginning to address environmental issues as they acknowledge the importance of sustainable interior design. While some interior designers are using environmentally sustainable design criteria in their design solutions, research that investigates how they apply it as a component for design problems has not been done. Knowing the state of practice will provide a base to develop education strategies for sustainable interior design. Interior design educators can identify less frequently applied components of sustainable design and develop teaching methods to improve the understanding of specific components. Continuing education courses can be developed for interior design practitioners as well. Therefore, this study examined the state of environmentally sustainable interior design practice.

Environmentally sustainable interior design: The interior design approach has been defined as the process of creative problem solving; a process of creative, constructive behavior^[1]. It is a systematic process of conscious thought that integrates academic knowledge with imagination. The design process can be viewed as a sequence of steps or stages^[2]. Both a traditional interior design approach and a sustainable interior design approach utilize programming, schematic design, design development, contract documents and contract administration. It is necessary to spend some time on each step before a design is complete.

In the traditional interior design approach, interior designers create, develop and communicate interior environment solutions that are functional and aesthetic. Designers work through the process to achieve functional quality of interior space and to provide

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aesthetics for the human senses. Cost is another important aspect for making design decisions in interior design projects. However, environmental issues and the need to support environmentally sustainable design have been beyond the scope of the traditional interior design approach.

In the traditional interior design approach, research indicates that interior materials are selected primarily according to the client's preferences, needs, aesthetics and cost^[3]. The impact of materials on the environment has not been shown as significant criteria for material selection. Interior designers commonly rely on the manufacturer's literature and rarely search for conflicting information for material selection^[4]. Many interior designers have limited knowledge of properties of materials that adversely affect the environment. Environmental issues are especially important in design development for the selection and specification of interior materials and products.

To achieve sustainability, it is important to pay attention to the factors that create environmentally sustainable design criteria. However, this does not mean less attention is paid to other traditionally significant interior design criteria. Environmental, economic and social dimensions must be in balance with one another for sustainable outcomes in the long term. Although there is no single definition of what constitutes sustainable interior design as Firey^[5] proposed, there are continuous trade-offs and negotiation among environmental, economic and social dimensions. Therefore, for the purpose of this study, sustainable interior design is defined as interior design in which all systems and materials are designed with an emphasis on integration into a whole for the purpose of minimizing negative impacts on the environment and occupants and maximizing positive impacts on environmental, economic and social systems over the life cycle of a building. It is noted that environmental issues have not significantly influenced the phases of the design process.

Environmentally sustainable issues in interior design are based on the sustainable design principles and strategies common for the built-environment. The Leadership in Energy and Environmental Design (LEEDTM) Green Building Rating System includes five environmental topics: sustainable site development, water savings, energy efficiency, material selection and indoor environmental quality. Sustainable design issues in the State of Minnesota Sustainable Building Guidelines are divided into performance management, site and water, energy and atmosphere, indoor environmental quality and materials and waste. Among these environmental issues, indoor environmental

quality and interior materials are the topics especially related to interior design.

Providing physiologically and psychologically healthy interior environment quality for occupants emerged as a crucial issue. For example, healthy indoor environments can increase employee health, which, in turn, can increase their productivity. This has a tremendous effect on overall employer costs, as workers are the largest expense for most companies^[6]. To improve indoor environmental quality, there have been concerns about indoor air quality and human comfort. An important part of interior design is the specification of suitable materials for the various components that make up a particular interior space^[7]. Use of environmentally preferable interior materials is an important to reduce the flow of nonrenewable resources into interior materials and pollutants from interior materials throughout life cycle of interior materials^[8]. Therefore, environmentally sustainable interior design implies working toward the promotion of indoor environmental quality by improving indoor air quality and human comfort and the use of sustainable interior materials.

MATERIALS AND METHODS

Population and sample: A national, Internet-based survey of interior design practitioners was conducted to examine the state of environmentally sustainable interior design practice. The population of this study was interior design practitioners in the professional interior design organization, American Society of Interior Designers (ASID). ASID is a leading professional organization for interior designers and the interior design community. ASID has more than 40,000 members comprised of 20,000 practicing interior designers, as well as students and industry partners. The sample for this study was selected from ASID practicing interior designers; specifically interior practitioners whose email addresses were available. Approximately 65% of ASID interior design practicing members use email. The membership email list was obtained from ASID and contained no personal or professional information. The sample size was determined based on a sample size formula, considering the response rate. The individuals were randomly selected.

Instrumentation: The survey information was collected at one point in time as cross-sectional. The questionnaire, a series of 35 written questions on interior designers' characteristics and environmentally sustainable interior design practices, was developed for

this study. The first draft of the questionnaire was pre-tested on 20 interior design practitioners to reduce ambiguity. They were excluded from the final sample. The questionnaire was revised in accordance with the results.

The format of the questionnaire was closed-ended questions, also known as multiple-choice questions. Respondents were asked to choose among alternative answers or scales provided by the researcher. The questionnaire began with instructions for the respondents. Questions were divided into two sections.

The first section was made of factual multiple-choice questions to ask the respondent's personal characteristics and professional credentials. The personal characteristics included geographic region of employment and practice. The geographic regions followed four regions and nine divisions defined by the U.S. Census Bureau. Regarding employment, each respondent was asked to indicate the geographical region in which his or her office was located. For practice, each was asked to indicate the place in which the majority of his or her regional and international interior design projects had been in the last two years. Guerin and Martin's^[9] stages of the career cycle of interior design practitioners were used to identify interior designers' professional credentials: education, experience, examination and legal regulation. Two questions regarding education were about a degree from a Council of Interior Design Accreditation (CIDA) (formerly the Foundation for Interior Design Education Research) accredited interior design programs and continuing education courses. Three questions regarding experience included years of practice, specialty and the size of typical interior design project. The examination question asked whether the respondent had passed the National Council for Interior Design Qualification (NCIDQ) examination. The regulation question asked whether the respondent was licensed or certified, if applicable, by his or her state in interior design.

The second section focused on environmentally sustainable interior design practice. Questions in this section were developed based on the Leadership in Energy and Environmental Design (LEED™) Green Building Rating System and the State of Minnesota Sustainable Building Guidelines. To understand the state of environmentally sustainable design practice, a series of statements were developed based on characteristics of global sustainable interior design, indoor environmental quality and interior materials.

Global statements were developed to examine the broader issues of sustainable interior design. These global statements were developed from the definitions

of environmentally sustainable interior design, indoor environmental quality and sustainable interior materials.

Environmentally sustainable interior design: Minimize negative effects and maximize positive effects of interior design on environmental systems over the life cycle of the building.

Indoor environmental quality: Provide an indoor environment that is physiologically and psychologically healthy.

Interior materials: Use interior materials that minimize resources used, waste generated and impact on environment throughout the life cycle.

Indoor environmental quality included statements for nine specific characteristics. It included four characteristics of indoor air quality and five characteristics of human comfort.

Indoor air quality:

- Meet the minimum requirements for indoor air quality
- Prevent exposure of building occupants to environmental tobacco smoke
- Prevent indoor air quality problems that result from the construction or renovation process
- Specify low-emitting materials and furnishings

Human comfort:

- Provide a high level of individual occupant control of thermal, ventilation and lighting systems
- Provide appropriate thermal conditions
- Provide a connection between indoor spaces and outdoor environments through the introduction of sunlight and views
- Provide appropriate lighting conditions and control of those conditions in an energy-efficient manner
- Provide appropriate acoustic conditions

Interior material had 14 specific characteristics based on a life cycle approach. It included three characteristics of input reduction, four characteristics of output management and seven characteristics of life cycle design.

Input reduction:

- Minimize the amount of materials used
- Facilitate disassembly for recycling or reuse
- Specify salvaged or refurbished materials

Output management:

- Develop and implement a waste management plan
- Reduce and recycle packaging waste
- Provide an area for the separation, collection and storage of materials for recycling
- Reduce and appropriately dispose of hazardous waste

Life cycle design:

- Specify recycled content material
- Specify locally manufactured materials
- Specify rapidly renewable materials
- Specify wood-based materials responsible for forest management
- Specify durable and long lasting materials
- Specify reusable, recyclable and biodegradable materials
- Specify interior materials with a low life cycle impact

For each statement, respondents were asked to rate it in three categories according to a Likert-type scale. The categories were frequency of application, importance to the designer’s firm and importance to the designer.

Data collection and analysis: An email/Internet survey was conducted in order to cover a large geographic area quickly. Instruments administered via the Internet appear to be reliable and are answered similarly to the way they are answered when administered via mailed paper^[10]. The email about this study was sent to those in the sample and asked them to visit a specified Web site to complete the questionnaire. To obtain a high response rate, an initial email, a second email after two weeks and a third email as a reminder to complete the questionnaire were sent. Descriptive statistics were used for the data analysis of this study. The statistics focused on frequency and percentage of distribution of interior designers’ characteristics and central tendencies of environmentally sustainable interior design practice.

RESULTS

Characteristics of the sample: The overall response rate was 7.66% with 305 usable responses. The frequency and percentage of distribution of characteristics of the sample are provided. Personal characteristics focused on geographic regions of employment and practice (Table 1). The South Atlantic

(23.6%) and West Pacific (21.0%) were the two divisions with the most respondents’ offices.

The West Pacific (22.3 %) and South Atlantic (21.3%) were also the two divisions with the most respondents’ projects. Only, seven respondents (2.3%) were involved in international projects.

Professional characteristics included respondents’ professional credentials regarding education, experience, examination and regulation related to interior design (Table 2). Education was evaluated on a degree from a CIDA accredited interior design program and continuing education courses or professional courses about sustainable design in the last two years. A degree from a CIDA accredited interior design program had been received by 63.6% of the respondents. 55.1% of the respondents had taken continuing education or a professional development course about sustainable design.

Experience was evaluated on the basis of specialty, number of years of practice and estimated size of interior design projects. The majority of respondents (57.4%) worked primarily in residential design, while over one-third of the respondents (37%) worked primarily in commercial design. The highest number of respondents (36.1%) has practiced more than 20 years. A large number of respondents (43.9%) reported the size of their typical interior design project as 3,001-6,000 sq. ft., which may reflect that the majority of respondents (57.4%) worked primarily in residential design.

Table 1: Personal characteristics

Characteristic	Frequency (N = 305)	(%)
Geographical region employment		
Northeast: New England	4	1.3
Northeast: Middle Atlantic	24	7.9
Midwest: East North Central	45	14.8
Midwest: West North Central	18	5.9
South: South Atlantic	72	23.6
South: East South Central	12	3.9
South: West South Central	40	13.1
West: Mountain	25	8.2
West: Pacific	64	21.0
Others	1	0.3
Geographical region practice		
Northeast: New England	6	2.0
Northeast: Middle Atlantic	23	7.5
Midwest: East North Central	42	13.8
Midwest: West North Central	19	6.2
South: South Atlantic	65	21.3
South: East South Central	12	3.9
South: West South Central	39	12.8
West: Mountain	27	8.9
West: Pacific	68	22.3
Others	1	0.3
No response	3	1.0

Table 2: Professional characteristics

Characteristic	Frequency (N = 305)	(%)
Degree from a CIDA accredited programs		
Yes	194	63.60
No	110	36.10
No response	1	0.30
Continuing education/professional courses		
Yes	168	55.10
No	136	44.60
No response	1	0.30
Specialty		
Child care	1	0.30
Financial institutions	3	1.00
Government/institutional	8	2.60
Health care	15	4.90
Hospitality/entertainment	11	3.60
Educational	13	4.30
Corporate/office	59	19.30
Recreational	0	0.00
Religious	0	0.00
Residential	175	57.40
Retail	3	1.00
Others	17	5.60
Years of practice		
2-5 years	51	16.70
6-10 years	50	16.40
11-15 years	48	15.70
16-20 years	46	15.10
More than 20 years	110	36.10
Size of interior design projects		
Less than 3,000 sq. ft.	73	23.90
3,001 to 6,000 sq. ft.	134	43.90
6,001 to 20,000 sq. ft.	60	19.70
20,001 to 50,000 sq. ft.	22	7.20
More than 50,000 sq. ft.	16	5.30
NCIDQ examination		
Yes	168	55.10
No	137	44.90
State licenses or certification		
Yes	140	45.90
No	163	53.40
No response	2	0.70

The question regarding examination asked whether a respondent had passed the NCIDQ examination. By passing a qualifying examination, NCIDQ allows an interior designer to be certified or licensed by the state. The question on regulation asked whether the respondents is licensed or certified by the state in interior design. About 55.1% of respondents had passed NCIDQ examination and 45.9% of respondents were licensed or certified by their states as interior designers, if applicable. This second figure may be misleading as some respondents might not be licensed or certified because their states do not have any form of legal recognition for interior design.

The characteristics of the sample are important as a means to assess the degree to which interior designers who responded to the survey are representative of the whole population, which is interior design practitioners who are members of ASID. The characteristics of the

respondents of this study could not be compared with the characteristics of the population because the characteristics of the population were not known. Although the sample of this study was randomly selected to represent the population, interior designers who are more familiar with sustainable interior design might have been more interested in responding to the questionnaire.

Findings: For each statement about environmentally sustainable interior design practice, respondents were asked to rate three dimensions: Frequency of application, importance to the designer's firm and importance to the designer. Every statement showed the highest mean score in the category of importance to the designer and the lowest mean score in the category of frequency of application. Important to the designer's firm ratings were always between these two extremes. This pattern occurred both in terms of global statements and in terms of more specific statements for indoor environmental quality and interior materials (Table 3). Interior designers perceive that environmentally sustainable interior design is important, but do not always put it into practice.

The statements showed similar distributions in three categories. To describe how environmentally sustainable interior design components are really applied to interior design projects, the frequency of application was compared among the statements. While interior designers responded that they have generally applied environmentally sustainable interior design, specific characteristics were usually less frequently applied to their projects. Among three global statements, indoor environmental quality (3.29) has the highest mean score. Environmentally sustainable interior design (2.48) and interior materials (2.47) were virtually the same. Generally, the global statements received stronger support than did the specific, detailed statements. The mean of indoor environmental quality (3.29) for the global statement was higher than the specific characteristics of indoor environmental quality except access to daylight and views (3.36). Likewise, the mean of interior materials (2.47) for the global statement was usually higher than specific characteristics of interior materials. However, durable materials (3.41), hazardous waste reduction and disposal (2.68) and local/regional materials (2.63) showed higher mean scores than the mean of the global statement, interior materials (2.47). It is assumed that interior design students and practitioners need an understanding of the specific characteristics of environmentally sustainable interior design in order to put it into application. These results may reflect practitioners' knowledge about sustainable interior design.

Table 3: Environmentally sustainable interior design practice

Environmentally sustainable Interior design practice	Frequency of application (Mean)	Importance to designer's firm (Mean)	Importance to designer (Mean)
Global			
Sustainable interior design	2.48	2.67	3.15
Indoor environmental quality	3.29	3.31	3.60
Interior materials	2.47	2.70	3.18
Indoor environmental quality			
Indoor Air Quality (IAQ)			
Minimum IAQ performance	2.82	2.95	3.28
Environmental Tobacco smoke control	2.88	3.24	3.47
Construction IAQ management plan	2.82	3.04	3.31
Low-emitting materials	2.62	2.81	3.16
Human comfort			
Controllability of systems	2.69	2.85	3.15
Thermal comfort	2.84	2.94	3.17
Access to daylight and views	3.36	3.45	3.72
Effective lighting	3.19	3.31	3.57
Appropriate acoustic control	3.05	3.20	3.44
Interior material			
Input reduction			
Reduced material use	2.46	2.61	2.87
Disassembly	2.19	2.46	2.88
Resource reuse	2.16	2.31	2.70
Output management			
Construction waste management plan	1.74	2.12	2.42
Packaging waste management	2.33	2.53	3.04
Area for recycling	2.44	2.63	3.03
Hazardous waste reduction and disposal	2.68	3.00	3.21
Life cycle design			
Recycled content materials	2.16	2.40	2.75
Local/regional materials	2.63	2.75	3.01
Rapidly renewable materials	2.33	2.53	2.88
Certified wood	2.35	2.58	2.92
Durable materials	3.41	3.44	3.62
Reusable, recyclable or biodegradable materials	2.33	2.61	3.03
Materials with low life cycle impact	2.13	2.42	2.72

Statements of indoor environmental quality included indoor air quality and human comfort. Among four statements about indoor air quality, environmental tobacco smoke control (2.88), which has been supported by law, showed the highest mean score, while low-emitting materials (2.62) showed the lowest mean score. Within human comfort, access to daylight and views (3.36), effective lighting (3.19), appropriate acoustic conditions (3.05) and thermal comfort (2.84) showed high mean scores. The most frequently applied characteristic within human comfort was access to daylight and views. This characteristic provides a connection between indoor spaces and outdoor environments through the introduction of sunlight and views into the occupied areas of the building where they can contribute to occupants' performance and productivity. Controllability of systems (2.69) was the lowest mean score in human comfort although it is still considered to have been applied frequently.

The means for statements about interior materials were lower than the means for statements about indoor environmental quality. For example, the lowest mean

score in indoor environmental quality, low-emitting materials (2.62), was usually higher than the mean scores of interior materials characteristics, except durable materials (3.41), hazardous waste reduction and disposal (2.68) and local/regional materials (2.63). Sustainable interior material was identified as a less frequently applied component of environmentally sustainable interior design. The statements about interior materials included statements about input reduction, output management and life cycle design. Among the three characteristics about input reduction, reduced materials use (2.48) showed the highest mean score, while disassembly (2.19) and resource reuse (2.16) showed low mean scores. Among responses to the statements of output management, hazardous waste reduction and disposal (2.68) was the highest mean score, while construction waste management (1.74) was the lowest mean score. Among seven characteristics of life cycle design, durable materials (3.41) and local/regional material (2.63) were high mean scores. However, recycled content materials (2.16) and materials with low life cycle impact (2.13) showed low

mean scores. The results indicated that construction waste management and materials with low life cycle impact were less frequently applied. It is suspected that interior designers are not responsible for environmental consequences over the entire life cycle of interior materials, which includes construction waste management for ultimate disposal.

DISCUSSION

Interior designers perceive that environmentally sustainable interior design is important, but do not always put it into practice. Environmentally sustainable interior design might not have been applied to interior design projects for different reasons. The efforts required to gain the knowledge and apply environmentally sustainable interior design to projects might be too time-consuming for the pressures of project scheduling. Interior designers might think that sustainable interior design requires additional indoor environmental systems and materials that are more costly. It might be difficult to encourage clients to adopt environmentally sustainable interior design solutions if they did not request such an approach or were not familiar with it.

From this study, interior design educators can identify less frequently applied components of sustainable interior design and develop teaching methods to emphasize the importance of these components. The findings of this study revealed that sustainable interior materials were less frequently applied components of environmentally sustainable interior design than indoor environment quality. It also appeared that interior designers were not aware of environmental issues related to the entire life cycle of interior materials. Therefore, teaching methods that improve awareness of the importance of sustainable interior design and an understanding of the life cycle impact of interior materials are needed in classes for undergraduates and in continuing education courses for practitioners.

The results of this study suggest the development of regulations for environmentally sustainable interior design practice. For example, environmental tobacco smoke control was a frequently applied characteristic as smoking has been prohibited inside many buildings throughout the US. However, the use of low-emitting materials and furnishings were infrequently applied to interior design projects. If additional regulations existed for limiting VOCs in adhesives, sealants, paints, composite wood products and carpet systems, the application of environmentally sustainable interior design practice for indoor air quality would be promoted.

Several research issues have been suggested for further study. Conducting the survey with a sample of the US members of the International Interior Design Association (IIDA) would add to this study. IIDA is a professional networking and educational association of more than 10,000 members around the world committed to enhancing quality of life through excellence in interior design and advancing interior design through knowledge. This further study would provide an opportunity for a stronger generalization to the population. Asking respondents about the importance of sustainability to clients could also expand the study. Clients might motivate or discourage an environmentally sustainable interior design approach even though interior designers are aware of the importance of such an approach. Another study, similar to the one just completed, could be conducted with senior interior design students at universities. This study would determine the state of environmentally sustainable interior design education. It could be compared to the state of practice to identify differences or similarities.

Research may be conducted among interior design practitioners to determine the factors that motivate them to practice environmentally sustainable interior design. While the current study revealed that interior designers consider environmentally sustainable interior design important, its application to interior design projects did not reach the same level as the perceived importance. Determining the reasons why interior designers are motivated to apply environmental characteristics to their design would provide direction to promote environmentally sustainable practice. Although interior designers are aware of the importance of environmentally sustainable interior design, concerns about cost for sustainable interior design might discourage them. A research study could be designed to examine the environmental and economic integrations of sustainable interior design. As sustainable interior materials were a less frequently applied component of environmentally sustainable interior design, a case study focusing on interior materials of green projects could be conducted. The characteristics of environmentally sustainable interior design practice might be more frequently applied if the benefits of such practice were more apparent. A research project could be designed to review and analyze the numbers that indicate bottom line savings from using an environmentally sustainable interior design approach.

CONCLUSION

Although interior designers acknowledge the importance of environmentally sustainable design, its

application to interior design projects did not reach the same level as its perceived importance. Use of sustainable interior materials was identified as a less frequently applied component of environmentally sustainable interior design than indoor air quality and human comfort. Within indoor air quality, environmental tobacco smoke control was the most frequently applied characteristic, while use of low-emitting materials was the least frequently applied. Within human comfort, access to daylight and views, effective lighting, appropriate acoustic control and thermal comfort were more frequently applied, while controllability of systems was less frequently applied. Reduced materials use was the most frequently applied characteristic within input reduction. Hazardous waste reduction and disposal was the most frequently applied characteristic within output management. Durable materials and local/regional materials were more frequently applied within life cycle design. However, construction waste management and materials with low life cycle impact were less frequently applied characteristics of sustainable interior materials. More studies about environmentally, economically and socially sustainable interior design will be necessary to contribute to the further refinement of an interdisciplinary body of knowledge in sustainable design. It is important to know the state of environmentally sustainable interior design practice. This study has made one such contribution.

ACKNOWLEDGEMENT

Funding received through an ASID Foundation-Irene Winifred Eno Grant, an Interior Design Education (IDEC) Foundation-Carole Price Shanis Scholarship and the University of Minnesota Graduate School Block Grant are highly appreciated.

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