Examining the Status and Future of Design for Sustainable Behavior

in Interior Design Education

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Abstract

Despite the building industry's commendable efforts for creating sustainable environments, numerous studies have shown buildings are not achieving the environmental goals designers and architects are predicting during the design phase. This has been attributed to a number of factors including occupants' unsustainable behavior patterns which affect the amount of energy and resources a building consumes. The effect of human behavior on sustainability has been studied by experts in various fields, it has not however, been sufficiently analyzed by interior designers. Although interior design authors have argued the field has transformed itself to an area concerned with human behavior, there currently are no established design processes or knowledge domains that can help interior designers understand and design to encourage sustainable behaviors. On the other hand, industrial designers have advanced Design for Sustainable Behavior DfSB, an area of research that intentionally uses design solutions to encourage sustainable behaviors. This research argued DfSB can help overcome the gap identified in interior design (ID) by providing ID with design strategies, design processes and precedent. As such this research focused on analyzing the current state of designing with the intention of changing behavior within ID education in order to reach recommendations for the integration of DfSB into ID.

The first phase of the study involved a nationwide questionnaire distributed to ID faculty members to gauge the current state of DfSB within ID, including faculty members' attitudes towards it, barriers to integrating it, recommendations for content and teaching methods along with any ethical concerns that may arise from intentionally changing behavior through design. Concurrently, a review of top ID programs online material was conducted to identify the presence of DfSB within existing courses. This phase demonstrated faculty members hold positive attitudes towards DfSB despite their limited familiarity and knowledge of the field which was identified as one of the major barriers to its integration. Additionally, despite none of the programs indicating students are taught how to encourage sustainable behavior through design, it was apparent a foundation for DfSB exists within ID due to the presence of sustainable design courses, human factors, and some social science courses.

Findings from the questionnaire spurred a group of questions that required a nuanced investigation through interviews with a sample of ID faculty. These interviews painted a clearer image of the current educational terrain and general directions within ID education. They also allowed the researcher to collate ideas for overcoming barriers to DfSB integration along with establishing recommendations for disseminating DfSB into ID education and practice in a manner that capitalizes on the resources currently available in ID and removes identified hindrances.

Abstract (Public)

Studies have shown that despite architects and designers efforts to decrease the building industry's negative impact on the environment, buildings are not achieving sustainability goals. This phenomenon has been studied by various fields in both the building and behavior sciences with authors attributing it to numerous factors, including human behaviors and choices in the built environment. To date, however, there have not been sufficient studies within interior design examining the effect of human behavior on sustainability. As such there are currently no established design process or knowledge resources for encouraging sustainable behavior within the built environment through the use of interior design. On the other hand, industrial designers have advanced the field of Design for Sustainable Behavior (DfSB), an area of study that intentionally uses design to achieve behavioral change. This research argued that adopting DfSB into interior design can help overcome the gap identified in interior design by providing knowledge resources, precedents and design processes for encouraging sustainable behavior through the use of design. Therefore, this research focused on examining the current state of interior design education, particularly in regards to sustainability and behavior, in order to present recommendations for integrating DfSB into interior design education.

The research was comprised of three stages, a survey of top interior design programs' online literature, a nationwide survey of interior design faculty, finally, in-depth interviews. These three stages of research focused on understanding the current state DfSB within ID education, identifying faculty member attitudes towards DfSB, barriers and recommendations and possible ethical concerns related to intentionally changing behavior through the use of design. Results indicated interior design faculty members hold positive attitudes towards DfSB despite their limited familiarity with the field, which was identified as a major barrier to its integration. Additionally, results indicate that although DfSB is not taught within interior design, a foundation for teaching it does exit due to the presence of courses such as sustainable design, human factors, and some social sciences within interior design curricula.

In-depth interviews with interior design faculty painted a clearer image of the current state of interior design education and allowed the researcher to collect ideas for overcoming barriers to DfSB in interior design. The research concluded by providing recommendations for including DfSB into Interior Design education and practice in a manner that capitalizes on the available resources and removes identified limitations.

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1. Introduction

1.1. Background

According to the U.S. Environmental Protection Agency, buildings account for 39 percent of total energy use, 12 percent of water consumption, 68 percent of electricity usage and emit 38 percent of carbon emissions (2014). As one of the largest contributors to environmental distress, buildings can also be one of the greatest contributors to the mitigation of this pressure (IPCC, 2014). In an effort to reduce the industry's impact on the environment, a number of organizations worldwide have introduced guidelines and certification criterions to ensure buildings meet an environmental standard. Most notable are the Building Research Establishment Environmental Assessment Methodology (BREEM) and the Leadership in Energy and Environmental Design (LEED) certification put forth by the US Green Building Council. Similarly in education, accreditation bodies such as the Council for Interior Design Accreditation (CIDA) updated their standards in 2006 requiring programs to include sustainable design in their curriculum (2014). The necessity of employing sustainable design is since quite established in interior design and no longer a subject of debate (Stieg, 2006). Stieg contends a great deal of progress has been achieved by academia in reaching a "plateau of basic understanding of sustainable design principles" (2006, p. vii). However, this basic understanding arguably cannot explain why buildings designed to sustainable standards often do not perform as well as anticipated.

Studies have shown that projections of building consumption made during the design process often do not accurately predict the amount of resources and energy a building will actually use. Some studies have indicated "on average 20% of expected energy savings are not achieved" (Gram-Hanssen, 2014, p. 92) and one study found the actual energy use of a multifamily building was 50% higher than predicted (Branco, Lachal, Gallinelli, & Weber, 2004). This gap between estimated and actual performance has been attributed to a number of factors, one of which is occupant behavior and the impact it has on building sustainability (Janda, 2009; Menezes, Cripps, Bouchlaghem, & Buswell, 2012; Roetzel, Tsangrassoulis, Dietrich, & Busching, 2010; Sunikka-Blank & Galvin, 2012; Yu, Haghighat, Fung, Morofsky, & Yoshino, 2011). At least three reports prepared for the US Department of Energy focused primarily on the importance of understanding and changing occupant behavior in order to reduce the gap between estimated and actual building performance (Pacific Northwest National Laboratory, 2012, 2013, 2014). Moreover, some have argued that as buildings become more structurally efficient "the role of the occupant [becomes] more important" (Santin, Itard, & Visscher, 2009, p. 1223). Behaviors such as temperature setting, opening of windows, using drapes, along with laundry and cooking habits (Fabi, Andersen, Corgnati, & Olesen, 2012; Sonderegger, 1977; Wood & Newborough, 2003) can all create

great variance in the amount of energy and resources consumed "even when equipment and appliances are identical" (Fabi et al., 2012, p. 188).

The impact of occupant behavior on sustainability spiked research in fields such as building science, psychology and behavioral sciences (Theodorson, 2014) with each field focusing on certain aspects of the phenomenon (Fabi et al., 2012). Theodorson maintained that "human-behavioral aspects of energy usage" are rooted in research from "sociology and behavioral science rather than in design perspectives" (2014, p. 41). She argues there have only been two significant papers in the past 35 years that address buildings, behavior and sustainability (see section 2.3. for a review). As such, there are no established knowledge domains, design processes or strategies in interior design that can help designers draw from multiple fields to understand, analyze and design for sustainable behavior. However, this gap can be overcome through building on findings proposed in another design field that has addressed this topic, namely; industrial design.

Industrial designers have advanced Design for Sustainable Behavior DfSB that is defined as "an emerging activity under sustainable design which aims to reduce the environmental and social impacts of products by moderating users' interaction with them" (Lilley & Lofthouse, 2010b, p. 55). Just as industrial design "swings between art and engineering," (Bhamra & Lofthouse, 2007, p. 3) so does DfSB extensively build on multidisciplinary resources successfully bridging knowledge between behavioral sciences and engineering. Scholars in DfSB have collated a group of behavior-changing strategies (see section 2.3.2) from various disciplines such as "social psychology, persuasive technology, sustainable consumption, industrial ecology, stakeholder analysis and interaction design" (Boks, 2011, p. 328). Through an understanding of factors that drive behaviors in a given context, the application of a user-centered design process (see section 2.3.3), and knowledge of sustainable technologies and systems, DfSB scholars can propose appropriate behavior-changing design solutions. Studies using DfSB have demonstrated environmental success with one study involving the redesign of a fridge resulting in a 43% reduction in energy use (Elias, 2011).

This author's research maintains it is possible to use knowledge gained from DfSB in interior design as the latter is also heavily "concerned with designing for human behavior" (Guerin & Thompson, 2004, p. 1). Integrating DfSB into interior design provides the field with 1) insights from relevant behavioral models, 2) design processes that use behavioral models and work with users to propose designs, 3) collated design strategies, 4) frameworks for choosing appropriate design strategies and solutions, 5) an overview of ethical considerations, and 6) an awareness of products that aim to change behavior.

DfSB may be introduced into interior design in a number of ways within academia and practice, however, as "education is the primary agent of transformation for achieving (…) sustainable design," (Boehm, 2015, p. 76) this research will focus on exploring DfSB's integration into interior design education. This could have great reach and influence as it ensures a new generation of designers, who are likely to "bring about the most change" (McLennan, 2004, p. 3) in the future, are familiar and well-versed in the area. Also, through research collaboration amongst academia and industry, DfSB can be disseminated into industry which can then pose questions back for researchers to explore.

1.2. Problem Statement

Numerous studies have indicated that buildings cannot achieve desired environmental sustainability levels without addressing occupant behavior (IPCC, 2014; Janda, 2009). Without proper understanding and consideration of behaviors that occur during a building's lifespan an estimate of 20% of savings predicted on drawing boards are not achieved (Gram-Hanssen, 2014). Such findings established the importance of changing occupant behavior and attitudes in order to achieve sustainable buildings (IPCC, 2014; Millennium Ecosystem Assessment Board, 2005).

Occupant behavior's impact on sustainability drove research in both building and behavioral sciences with each area contributing significant findings (Fabi et al., 2012). These studies however, remain field-specific and not easily accessible by designers (Sorrento, 2012) at a time when sustainability "requires knowledge, methods, and theories drawn from multiple disciplines" (The Designers Accord cited in: Boehm, 2015, p. 77). Interior designers are arguably equipped to adapt and blend findings from various fields (Lawson, 2005) and can use these findings to create spaces that encourage sustainable behaviors. To date, however, the relationship amongst design, sustainability and behavior has not generated much research in interior design (Theodorson, 2014). It has, nonetheless, been extensively explored by industrial designers who have advanced the area of Design for Sustainable Behavior DfSB. DfSB utilizes an understanding of behavioral models and applies a user-centered design process to observe, analyze and propose behavior-changing designs.

As there are no established knowledge domains, processes or strategies in interiors to design for sustainable behavior, this study proposes that the integrating of Design for Sustainable Behavior into interior design can help overcome this gap. Integrating DfSB provides interior design with a rich foundation of inter-disciplinary knowledge, design strategies and case studies on which to build. Understanding DfSB and applying it into interior design can be accomplished through different methods,

however, as education is considered a primary agent for achieving sustainability (Boehm, 2015), this research, will focus on integrating DfSB through including it in US interior design programs.

Despite there being little published on the relationship amongst interior design, behavior and sustainability, it is possible that university programs do teach aspects of the topic. It is therefore crucial to identify the baseline of knowledge available in interior design so that DfSB can complement existing material. Secondly, capturing faculty's knowledge of DfSB, their evaluation of its usefulness for interior design and their willingness to incorporate it into their curricula, is crucial for the success of its integration. Through a review of online materials available on websites of prominent interior design programs, particularly those renowned for their focus on sustainability, this research determined how, and if, the interrelationship among design, behavior and sustainability is advertised and stressed to new and existing students and larger community. Additionally, an online questionnaire distributed to interior design faculty followed by interviews with volunteers 1) identified the current state of design for sustainable behavior in interior design curricula, 2) explored faculty evaluation of DfSB, its applicability and importance to interior design, and 3) identified ways of integrating DfSB further into interior design education.

1.3. Research questions

Through the exploration of the following questions, this research will reach recommendations for integrating DfSB into interior design education.

1. What is the current state of Design for Sustainability in undergraduate interior design programs in the U.S.?
2. What are the barriers to incorporating Design for Sustainable Behavior into interior design and how can they be overcome?
3. What should an interior design education encompassing DfSB include and how should it be taught?
4. What are the ethical concerns to applying DfSB in interior design?

1.4. Research objectives

The aim of this research is to develop a vision for incorporating DfSB within US interior design education based on an exploration of ID faculty members' understanding and position on DfSB and its basic tenets and goals. This will be achieved through the following objectives:

1. To conduct a comprehensive literature review that explores 1) DfSB basic components, namely; sustainable design, behavior and design particularly interior design, 2) DfSB components and ethical considerations and 3) DfSB education within industrial design.
2. To investigate DfSB presence within Interior Design ID programs by conducting a review of leading ID programs' online material including mission statements, syllabi and course descriptions.
3. To conduct a nationwide questionnaire exploring ID faculty's understanding, evaluation and commitment to DfSB along with barriers to incorporating it into ID.
4. To carry out interviews with ID faculty members seeking clarifications on questionnaire findings and sketching a vision for integrating DfSB into ID education and industry.
5. To draw recommendations for the integration of DfSB within U.S. interior design education programs.

1.5. Contributions

This research evaluated the current state of DfSB within ID programs and gathered ID faculty members' suggestions on integrating it further within ID. It also identified potential barriers to including DfSB and ways of overcoming them. It also gauged ID faculty members' position on ethics as it relates to DfSB education. Finally, it presented initial suggestions for integrating DfSB into ID and identified future work necessary for the growth of DfSB education with ID.

1.6. Limitations

This study is limited to interior design programs within the U.S. and did not include international programs. It is also limited to the online material, course descriptions and syllabi published during the time of this study (2015 – 2016). This research focused on the discussion of integrating DfSB not on carrying out of the integration.

1.7. U.S. Interior Design Education for the International Reader

As this research study was limited to ID programs within the U.S., an overview of agencies that affect interior design education in the U.S. will be briefly discussed here to provide context for the study. This overview is not meant to be exhaustive as the study and documentation of ID education within the U.S. is beyond the scope of this research, however topics that have affected faculty members' response to this research's question are highlighted.

For interior designers in the U.S. four main entities are of importance, the Council of Interior Design Accreditation (CIDA), the Interior Design Education Council (IDEC), the National Council for Interior Design Qualification (NCIDQ) and finally the American Society of Interior Designers (ASID). Although the first two entities relate directly to education and the latter groups are associated mainly with industry, the four effect decisions and directions within interior design industry and education to different extents.

The groups most relevant to this research study are the Council of Interior Design Accreditation (CIDA) and the Interior Design Education Council (IDEC). IDEC is dedicated to the advancing of ID education and research through the efforts of its members. IDEC member are comprised mainly of educators and have served as the main sample for this study. CIDA on the other hand, is a recognized authority on ID education by the Council for Higher Education Accreditation and has actively promoted high academic standards in ID for over thirty-five years (CIDA). CIDA aims to ensure high quality interior design education through three main pursuits: 1) setting standards for education, 2) evaluating and accrediting ID programs, and 3) facilitating outreach and collaboration with various ID stakeholders (CIDA).

According to CIDA's website, there are over 150 accredited programs and although accreditation is not limited to the U.S., the majority of those programs are national with only a few international ones. Both the number of programs that have pursued accreditation and the emphasis accreditation receives on ID websites indicates most, if not all, ID programs find value in achieving CIDA recognition. ID accredited programs are also valued by professionals in industry who have indicated they believe it is very important for new ID students to graduate from accredited programs (DesignIntelligence, 2014, p. 75). With ID programs and professionals both relying on CIDA as an indicator of quality education, the standards it establishes along with the accreditation process it uses have arguably shaped the manner through which faculty organize and emphasize ID's body of knowledge[1].

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[1] Faculty responses to both this research's questionnaire and interview results (see chapters 4 and 5) indicate CIDA accreditation affects curricula decisions.

As the majority of programs CIDA accredited are U.S. based, it may be argued its influence makes ID programs in the U.S. unique; consequently, some of this research's results may differ if conducted in a different country.

1.8. Author's Background

As a research's background and biases may color a study, a brief overview of the author is offered here. The author holds a Bachelor's degree in Interior Design along with a Masters of Art in Interior Architecture. During her master's project, the author became interested in design psychology and the intricate relationship between spaces and the people they are designed for. After holding both academic and professional positions, the author returned to pursue a doctoral degree in interior design with a renewed interest in the interplay between design and the human condition. In exploring this area, the author found Design for Sustainable Behavior, a field that aims to advance socially and environmentally influential design solutions by leveraging a deeper understanding of people and their behaviors. It may be noted that the author did not intend to integrate DfSB into an ID program as part of this PhD study, instead the aim was to uncover whether such an integration would find support and acceptance amongst ID faculty. It is hoped that this has allowed the researcher to maintain an appropriate level of neutrality while pursuing this research.

2. Literature Review

This research centered around three main components that share complex relationships (Figure 1). The first component, sustainable design, is increasingly employed by designers and architects to negate the building industry's negative impact on the natural environment. Concerns over the effect of behavior, the second component, emerged after research demonstrated the way people behave within buildings greatly affect designers' sustainability targets. As a result, interior design has surfaced as an area that could potentially influence occupant behavior allowing buildings to achieve sustainable goals designers and architects propose.
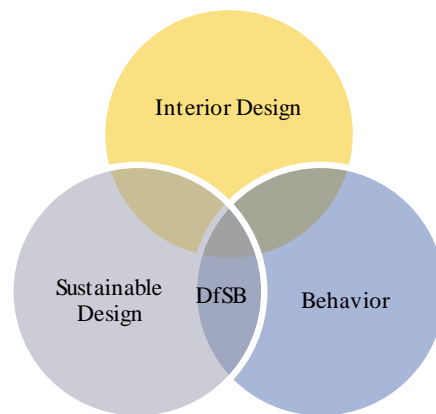
Figure 1- Three main components of this research study

Consequently, this literature review starts with a brief discussion of these three components and the intricate relationships they share. It then moves into the field of Design for Sustainable Behavior (DfSB), an emerging area under the banner of sustainable design championed by industrial designers. DfSB can present interior designers with a strong foundation of theories, design processes and case studies ID can then adapt and build on in a manner that fits their respective medium and industry, namely; interior spaces. After a brief introduction of DfSB and its components, the review explores examples where DfSB was introduced to students within industrial design education.

2.1. Sustainable Design

DfSB exists under the umbrella of sustainable design, which makes the latter a logical starting point for this literature review. Understanding the various directions within sustainable design and the relationship it shares with behavior contextualizes DfSB and justifies its arguments and aims.

2.1.1. Directions within sustainable design

As established in the introduction (section 1.1) the building industry is one of the largest contributors to environmental deterioration through its rapid consumption of resources and emitting of toxins (IPCC, 2014; U.S. Environmental Protection Agency, 2014). To counter these negative impacts, architects and designers shifted towards sustainable design solutions. But what is sustainable design? Cook and Golton (1994) argued sustainable design is what Gallie (1956) terms an *essentially contestable concept*; a "concept where there are ongoing disputes about the nature and definition which are unlikely to be resolved" (1994, p. 679).

Nonetheless, within these ongoing disputes over the definition of sustainability at least two main directions exist: that the first champions technological advancement and the second that seeks an ecological approach. Proponents of a technological approach recognize there are ecological problems and "want to 'solve' them through management of the environment and the use of technology and science" placing faith in "objective analysis and a rational scientific approach" (Cook & Golton, 1994, p. 677). On the other hand, those in favor of an ecological approach believe man is part of an interconnected ecosystem and therefore should exercise constraint on economic and population growth (Cook & Golton, 1994).

Although some view these competing paradigms as problematic, others see fault in a persistent pursuit of a unified and stable knowledge base from which to build sustainable design (Guy, 2005). Those who hold this belief argue sustainable design should be treated as a means of "raising awareness of all the issues that can be considered" (Cook & Golton, 1994, p. 684). This approach does not undermine the importance of including technological innovations rather it refuses to limit sustainable design to the dominant "positivistic scientific assumptions" (Guy & Farmer, 2001, p. 146) and prefers a "social constructivist" (Guy & Farmer, 2001, p. 146) approach, one that recognizes that individuals and groups have their own interpretation of what causes unsustainability and hence what can solve it.

This latter understanding of sustainable design that embraces the nuance, needs and understandings of individuals and communities is arguably suitable for investigating occupant behavior and the effects that it has on sustainability, a topic central to this research. Occupant behavior has been identified as one of the main factors that affect the success of sustainable buildings and is therefore discussed further below in section 2.1.2.

2.1.2. Impact of behavior on sustainability

As a contestable topic, disputes over sustainable design's definition and application will likely continue, perhaps to no unified end (section 2.1.1). Nonetheless, dedicated individuals and groups have applied their knowledge into both academia and practice. Sustainable design within education, particularly ID, will be discussed in section 2.2.1. Within practice however, designers and architects are faced with a notable obstacle, namely; buildings not meeting predicted sustainability goals.

Numerous studies have pointed to discrepancies between predicted building performance and actual performance and have attributed this to a number of factors (Janda, 2009; Menezes et al., 2012; Roetzel et al., 2010; Sunikka-Blank & Galvin, 2012; Yu et al., 2011). Steemers and Yun (2009) collected and analyzed data from 4822 housing units across the United States to establish the extent to which different factors affect energy efficiency. The factors they studied included climate, building characteristics, occupant behavior and socio-economics. They found that climate and building characteristics are insufficient for determining energy demand and that occupant behavior, specifically as it relates to heating and cooling, is the second most important parameter that determines energy use. Similarly, a number of studies across different periods and locations have statistically explored this phenomenon, for example, a study of energy use in Swedish homes attributed 4.2% of energy variance to occupant behavior (Santin et al., 2009), while Sonderegger (1977) attributed 71% of energy variance in heating across U.S. households to behavior choices.

Such studies have demonstrated the importance of understanding and changing behavior within the built environment in order to achieve higher levels of sustainability. For instance, a report entitled; *Climate Change: Implications for Buildings*, published by the University of Cambridge, highlighted the importance of "changing user behavior and attitude" (IPCC, 2014, p. 5) as one of the actions required to create sustainable buildings. Similarly, Janda (2009) argued building professionals should "accept greater responsibility" (p. 1) for the role they can play in influencing occupant behavior. Therefore the following section will examine ID and the role it can potentially play in changing behavior and increasing sustainability.

2.2. Interior design, education and sustainable behavior

This section will review sustainable design within education along with the influence of design on behavior in both general terms and specific ones (sustainable behaviors). Two seminal works within ID, Sorrento (2012) and Theodorson (2014), have explored the triangular relationship (sustainability, interior design and behavior) and will accordingly be reviewed in depth.

2.2.1. Sustainable design and interior design education

Despite the varying opinions on sustainable design (described in section 2.1), Boehm (2015) argued the building industry, particularly interior design, demonstrates commitment to sustainable design in multiple ways, including its integration into ID educational standards and design practice.

Sustainable design within ID has been endorsed by both the International Interior Design Educators Council (n.d.) and the Council of Interior Design Accreditation (Gürel, 2010). Such endorsements, along with individual efforts in academia and practice, created a "plateau of basic understanding of sustainable design principles" (Stieg, 2006, p. vii) within ID. Some claim including sustainable design in ID education is part of the "profession's ethical obligation" (Lee, 2014, p. 158) to provide society with environmentally responsible individuals (Gürel, 2010).

Education programs across the US have embraced this direction within ID and have mandated the inclusion of sustainable principles in their curricula (Lee, 2014). Nonetheless, educators and students are still faced with a number of challenges. One challenge is students' tendency to interpret sustainable design through mainly technological solutions (Boehm, 2015; Gürel, 2010). In a study aiming to introduce students to the complex issues of sustainable design through studio, Gürel (2010) noted students' initial inclination was to rely heavily on high-tech solutions (examples: photovoltaics, geothermal heating) to illustrate their commitment to sustainability. She attributed this to the prominence of these solutions in literature and the internet, however, this could also indicate that education within ID stresses these solutions over other common architectural components (example: wind catchers, light shelves and shading devices) and behavioral issues. Similarly, some faculty members interviewed by Crane (2008) expressed concern over sustainable design being limited to a discussion on materials and product specification. However, as this finding appeared during interviews it may arguably not be generalizable to all ID programs.

Through reviewing ID faculty members, Crane (2008) found that sustainable design is often integrated throughout the curriculum and mainly within studio courses. Faculty hope integrating sustainability into multiple classes as opposed to offering it as a stand-alone course will enable students to view sustainability in a holistic manner as opposed to a segmented and compartmentalized concept (Crane, 2008). Similarly, Gürel (2010) argued introducing sustainability as a discrete course offered by experts in the field is most likely an inefficient way through which to integrate the topic. Rather, Gürel (2010) proposed sustainable design should be included in all topics so that it may become "a way of thinking that shapes the way prospective designers process information and adopt environmental consciousness" (2010, p. 197)

Incidentally, some of the findings in ID match those found in a study conducted with industrial design educators who also found students tended to compartmentalize their learning of sustainable design. Watkins' (2013) study in industrial design revealed that faculty members also believe integrating sustainability into the curriculum and in studio projects presented students with a more holistic and contextualized understanding of sustainable design as opposed to a segmented one.

Another challenge identified within ID is incorporating sustainable design into a curriculum that already includes many important topics (Crane, 2008; Gürel, 2010). Additionally, faculty members' varying knowledge and ability to incorporate sustainable design is also perceived as somewhat of a barrier to advancing sustainability within ID (Crane & Waxman, 2009; Lee, 2014). However, Gürel (2010) points to a number of avenues for faculty to increase their knowledge including: conferences, publications, certifications and workshops. Despite the availability of these avenues, some faculty interviewed by Crane cited financial concerns constrain perusing such opportunities as workshops and certifications can be quite pricey particularly when faculty members have to pay for them out-of-pocket (2008).

In his interviews of ID faculty, Crane (2008) found sustainable design is mainly introduced through building construction, materials and methods, life-cycle analysis of a material, indoor air quality, energy efficiency, lighting, LEED and cradle to cradle concepts. There were some faculty members however that discussed sustainable design more holistically touching on issues of social responsibility and interior design's ability to "shape human behavior" (2008, p. 81). An interviewee even believed sustainable design within ID presents an opportunity for designers to sway behaviors towards sustainable practices. Such a remark is promising for the purposes of this research as the notion of intentionally using interior spaces to encourage sustainable behavior is central to this study and will therefore be explored further in the following sections (2.2.2 and 2.2.3).

2.2.2. Design and behavior

Buchanan, a design theorist, maintains all design is a form of deceleration and a persuasive communication that influences users' behaviors, attitudes and values (1985). Similarly, Marmot believes, "designers often aspire to do more than simply create buildings and places that are new, functional and attractive—they promise that a new environment will change behaviors and attitudes" (2002, p. 252). Moreover, in the case of interior design, Guerin and Thompson argue interior design has grown from a field primarily concerned with ornamentation and beautification to one that is "concerned with designing

for human behavior" (2004, p. 1). It is, however, crucial to identify the extent to which the built environment can indeed influence behavior.

The degree to which buildings and behaviors impact each other has been explored by multiple authors including Lang in his book on architecture theory. Lang presented four schools of thought concerning this relationship: "free will" followed by a "possibilisitc" relationship, a "probabilistic" one and finally "deterministic." The free will position claims the environment "has no impact on behavior" (1987, p. 100) while the deterministic view holds a contrasting position declaring the environment as "the major determinant of behavior" (1987, p. 100). On the other hand, the possibilistic and probabilistic positions fall in between the two dichotomies with the former perceiving the environment as a series of possibilities or *affordances* and the later predicting behavior based on individuals' attributes, environmental characteristics and personal motives. Lang explained the probabilistic approach through an example: "given an individual A with attributes a, b, c, set in an environment E with characteristics d, e, f, and with the Motivation M, it is probable that A will perform behavior B" (1987, p. 188).

It is arguably too simplistic to adopt a free will or a deterministic view, for the relationship between environment and behaviors is extensively researched and established by environmental psychologists making it unreasonable to claim the two have no impact on one another. Similarly, most academics do not support a deterministic view because to assume the environment is the major determinant of behavior disregards layers of social and psychological influences that do, in reality, drive behavior (Kopec, 2006). Particularly when it pertains to using the built environment to change behavior, both the possibilistic and the probabilistic approaches are arguably more appropriate as they neither entirely relinquish the power of influencing behavior to the environment nor do they deny its role completely.

Moreover, industrial designers using design to change behavior through products (also referred to as Design for Sustainable Behavior scholars) adopt similar positions on the relationship between product design and behavior. The possibilistic approach, for instance, is very similar to the concept of affordances originated by Gibson and popularized by Norman. Gibson (1979) defined affordances of the environment as what it provides for its users. On the other hand, Norman argued the true relevance of affordance for designers is not what the environment or design truly affords but "what actions the user perceives to be possible" (Norman, 1999, p. 39).

Similarly, the probabilistic position offered by Lang, is very similar to behavior models and theories of change found in social psychology, a field central to DfSB. Darnton explained behavior models are used to "understand specific behaviors, by identifying the underlying factors, which influence them" and theories of change are employed "to support interventions for changing current behaviors" (2008, p. 1). It

may be argued, that parallels can be drawn between factors included in the "60 social-psychological models and theories" surveyed by Darnton (2008, p. 1), and the three factors Lang identified in his definition of a probabilistic position, namely; the individual's internal attributes, the environmental characteristics, and norms that form motives (for more on social psychology see section 2.3.1).

The concept of affordances along with social psychology's behavior models form a foundational part of the theoretical fields DfSB scholars draw from (see section 2.3.1). Lockton argued designers can benefit from affordance by "hiding or revealing affordances[2], or deliberately creating false affordances[3]" (2013, p. 45) in order to change people's behaviors. Similarly, Wilson explains that models of behavior from social psychology help designers "explore and understand the multiple facets of behavior through a simplified representation of complex social and psychological structures" (2013, p. 13).

By accepting a possibilisitic and probabilistic approach to buildings and behavior, interior designers can benefit from theories of affordance and social psychology. Therefore, this research accepts both possibilisitic and probabilistic approaches, maintaining that "buildings offer suggestions instead of making laws" (de Botton, 2006, p. 20) and that people often respond to these suggestions[4] (Lawson, 2001). This position allows interior designers to understand behavior and theories of change, and then design-in suggestions that encourage sustainable behaviors in the built environment.

Although not extensively, literature in interior design has explored ways of impacting behavior through design, if only in general terms as demonstrated in section 2.2.3.

2.2.3. Interior design, behavior and sustainability

Interior spaces can affect occupant behavior by optimizing "desired behaviors and/or minimizing undesired behaviors" (American Society of Interior Designers). Occupant behavior in turn affects a building's environmental performance often contributing to it consuming more energy than estimated as discussed in section 2.1.2 and illustrated in Figure 2. Therefore, one way to achieve better-performing buildings is to capitalize on this influence process so that interior spaces can influence occupant behavior which in turn can positively affect sustainable building performance.

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[2] Hiding the thermostat from occupants and highlighting an operable window encourages people to use natural cooling on a warm day ultimately conserving energy.

[3] The *close* buttons on most elevators do not actually control when the door is shut they only provide the perception of control increasing a person's patience (or frustration).

[4] Lawson uses the example of ropes that form lines, although physically the rope has no ability to force people to stand in an orderly fashion, people see the rope and interpret its meaning and behave accordingly.

Figure 2- The relationship between interior design, occupant behavior and building performance

As discussed in 2.2.2, the relationship between design and behavior is well established in the literature including ID as interior designers, like other designers, are inherently in the "behavior business" (Fabricant, 2009). In fact, in their *Review of Interior Design Education in the 21st Century*, authors Guerin and Thompson explained that interior design as a profession has grown from one primarily interested in ornamentation and beautification to one that is "concerned with designing for human behavior" (2004, p. 1). Similarly, Thaler and Sunstein argued "there is no such thing as a 'neutral' design," (2008, p. 3) claiming every decision a designer makes will affect behavior in one manner or another, even deciding not to make a decision will affect behavior. They therefore believe it is necessary for designers to consider the ways through which their designs will affect behavior and perhaps influence users towards desirable behavior (2008). In the context of sustainable buildings, interior designers can use their skills to encourage occupants to choose pro-environmental behaviors that harm the environment "as little as possible, or even benefit the environment" (Steg & Vlek, 2009, p. 309)

Despite the apparent consensus on the role interior design can play in regards to behavior, Theodorson (2014) noted very limited work has been published on the topic. Nonetheless, in two separate *Journal of Interior Design* issues Sorrento (2012) and Theodorson (2014) presented pioneering work in the area. They both argued interior designers are uniquely positioned to address behavioral issues within the built environment due to their interdisciplinary foundation. Furthermore, Sorrento (2012) argued occupant behavior falls within the realm of interior designers more so than other professions within the building industry. She avidly urged interior designers to embrace a holistic approach to ID, one that focuses on both improving buildings and changing occupant behavior and "help guide the future of sustainability toward a more occupant-centered one" (2012, p. xx). Sorrento started by contextualizing her position on sustainable design in general and argued the need to move from a mechanistic worldview to an ecological one. She proposed employing an "integrative design process" which "stimulates collaboration among a diversity of practitioners with different disciplinary backgrounds and viewpoints to make human- and natural-systems-based connections and interrelationships" (2012, p. xv).

To illustrate her point she used her work on the United States Green Building Headquarters as a case study. During this project, Sorrento worked among a team of experts on building system and human

systems (lighting, acoustics, biophilia) along with architects and interior designers. She discussed three main sustainable solutions the team proposed for heating, ventilation and air-conditioning (HVAC), daylight management and advanced sensors. The eco-corridor was meant to manipulate temperatures so that less cooling or heating would be used in areas with low use, namely; corridors. The concern Sorrento presented to the team was that occupants seated near these corridors would be thermally uncomfortable; the solution was to build enough flexibility into the HVAC systems in case the teams' predictions were inaccurate and the occupants were indeed uncomfortable due to temperature variation. Second, to ensure the entire space received enough natural lighting and no glare, interior layouts and finishes were used to bounce light further into the space reducing the risk of occupants having lower light levels. Finally despite agreeing with Cole and Brown on their claim that "occupant's pleasure, comfort and productivity are closely linked with their real and perceived control over interior environments," (2009, p. 44) the design used sensors that control daylight, thermal adjustments, ventilation, acoustics and power receptacles arguably limiting occupant control over their environment to an extent. These solutions were arguably quite mechanistic and technology reliant and according to Sorrento required a long adjustment period. She argued a long adjustment is predictable due to the findings of "comfort adaptation research" (2012, p. xviii) but did not expand on the reasons for the longer period or the method through which, as an interior designer, she helped occupants with this process.

Sorrento (2012) made two strong arguments; the first was that interior designers should assume the role of occupant advocates, placing occupants' best interest first regardless of the design approach. The second was that interior spaces can be used to change occupant behavior. In her discussion of the case study, Sorrento was able to demonstrate the positive influence she had within a multidisciplinary team, particularly as an advocate for the occupant. She repeatedly urged the team to consider the influence their decisions would have on people's well-being, comfort and productivity. It is less evident however, how the building could or had changed behavior as the extent of "using buildings as tools to engage and educate" (p. xix) occupants was limited to helping "them learn to accept and use the innovations" (p. xix) the team had incorporated into the interior as opposed to working with occupants' changing needs or environmental worldviews for example. Although a valuable addition to ID literature and a definite move in a positive direction towards further discussions on occupant behavior and sustainability, Sorrento's work arguably did not present a method or process through which to understand and change occupant behavior.

Theodorson's (2014) work came closer to this objective, particularly due to her broader discussion of behavior and comfort. Like Sorrento, Theodorson began by contextualizing her argument and indicated there are two approaches to reducing energy in buildings: efficiency and conservation. She defined

efficiency as "getting more work from the same amount of energy" (p. 41), whereas conservation referred to "using less energy through reduced demand" (p. 41). Thoedorson believed efficiency is an important approach but has its limitations and advocated instead a conservative one. This latter approach translated into energy responsibility shifting from engineering, "efficiency through systems" (p. 42) to design that includes: setting, skin[5] and "educated and engaged" (p. 42) occupants. Next, she explored knowledge areas relevant to interior design and human factors, namely; behavior change, technologies, and human comfort. Within human behavior, Theodorson cited research that indicated information campaigns, though extensively used, do not often yield results because despite "enhanced knowledge" (p. 42) people do not often behave as desired or as predicted due to a host of social, psychological, economic and cultural reasons. She therefore argued that, it is important "to identify and target the information gaps and barriers that impede adoption of successful energy behaviors" (p. 42) through the aid of social science models. In terms of technology's influence, Theodorson stipulated advancements and increased automation brought on by technology has created a distance between the user and the control of building systems. The article also predicted future notions of comfort may need to be reassessed and revisited in order to allow for more sustainable buildings. Literature on the importance of redefining the notion of comfort is extensive and beyond the scope of this review, however it has been discussed in multiple publications (see: Chappells & Shove, 2004, 2005; Cole & Brown, 2009; Cole, Robinson, Brown, & Meg, 2008; Cupples, Guyatt, & Pearce, 2007; Kuijer & de Jong, 2012).

Upon contextualizing the argument, Theodorson proposed using an integrated design process[6] based on multidisciplinary collaboration involving stakeholders in projects from "conception to occupation" (p. 44). Theodorson discussed a three stage human-centered[7] process from predesign, design to post-design where users play a vital role in this process as illustrated in Table 1.

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[5] A building's skin is its exterior façade.
[6] This is based on AIA's Integrated Delivery Guide (2007)
[7] Theodorson also relies on human-centered instructions outlined by Passive and Low Energy Architecture (2009)

Design activity	Interiors + human centered Energy determinants
Predesign	
Eco-design charrette	• Initiate team building, inclusive of occupants • Establish importance of occupant in energy profile • Influence leadership toward eco-design perspectives • Discussion of automation vs. autonomy • Set measurable energy goals, considering human-behavioral inputs • Align occupancy patterns with energy requirements • Align spatial organization with climate resources
Programming	• Review comfort criteria in consideration of personal adaptation • Passive building = active occupant
Form and sitting	• Align human functions with climate and microclimate resources
Design	• Consideration of systemic inhabitant – architecture interactions relative to energy conservation strategies
Space planning, fittings and finishes	
Interior systems	• Consider human-technology interfaces • Provide multiple adaptive controls for thermal and luminous comfort provisioning
Post-design	• Consider human-technology interfaces • Provide multiple adaptive controls for thermal and luminous comfort provisioning
Commissioning	• Fine-tune behaviors • Verify performance with occupancy
Post-occupancy evaluations	• Increase understanding of inhabitant-architecture interactions

Table 1- Recreated from Theodorson's interior and human-centered energy determinants throughout design process (2014, p. 47)

In her article Theodorson discussed her process in relation to both energy and lighting concerns, however this review will only focus on energy as it can be considered representative of both. According to Theodorson, in energy efficient design, user involvement can have the following benefits:

1. Including occupants in *predesign* establishes their importance in a building's energy profile.
2. Allows the design team to have an early discussion on automation versus autonomy[8] gauging occupant preference and comfort.
3. Helps align occupant behavior patterns with energy requirements.
4. Within the *design* phase, including occupants enables designers to align the building's site and form with human activities and needs.
5. Through *post-occupancy* studies designers can educate occupants on a building's passive design and "fine-tune systems in accordance with patterns of occupancy" (p. 51).

Theodorson arguably pioneers the practice of incorporating occupant behavior into sustainable interior design[9]. Her work lays the foundation for future work in ID however it does not extensively deal with the

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[8] Automation versus autonomy refers to the types of technologies used that either allows occupants to control their environment (e.g. cooling, heating, lights) or controls the environment for the users (e.g. sensors for lights, predetermined cooling and heating).

issue of understanding and changing behaviors using the built environment. The assumption with her work is that through engaging the user throughout the design process an educational exchange will occur between all stakeholders (designers, owners and occupants) allowing the design team to arrive at proposals that meet the occupant needs and sustainability goals. It also assumes that a "committed and knowledgeable end user" (p. 51) could increase energy efficiency. These suggestions are rational and probably influential, however, as Theodorson points out; increased knowledge does not always result in the desirable behavior occurring due to a host of socio-psychological issues. Her process may benefit from a structured method through which specific barriers to sustainable behavior are understood and interior designers can then aim to overcome these barriers through their proposals. Social psychology explores different barriers to behavior and is a pivotal field within DfSB (as discussed in section 2.3.1) and can therefore be of aid to future ID work in the area.

Another contribution DfSB can add to Theodorson's work fits within the post-occupancy phase. She stressed the need to validate whether design intentions were successful upon completion and occupancy through performing post-occupancy studies. Unlike Sorrento, Theodorson suggested building sustainability can be increased through both educating the occupant on the technologies in their building along with adjusting these technological systems in accordance with behaviors. Although education and design adjustments can help in meeting sustainability goals, they are not the only strategies that can do so. Additionally, lack of knowledge may not be the only barrier causing a discrepancy between a design's intent and occupant behavior. Depending on the factor driving occupants to behave in unsustainable ways, a designer can choose to apply a number of design strategies that can influence occupants to make sustainable choices. DfSB contains a collation of such strategies (section 2.3.2) that may be adapted by interior designers.

Theodorson's user-centered design process is advocated by DfSB designers as well (section 2.3.3) due to its array of advantages some of which were outlined by Theodorson as explained above. This increases the compatibility between her work and DfSB and can make adapting DfSB into ID relatively smooth.

DfSB can add both depth and breadth to the valuable foundation laid by Theodorson and Sorrento, through posing critical questions along with potential answers to issues such as: what unsustainable behaviors are occurring in the space, why are they occurring, which behaviors should be changed, and how can they be changed? Collectively, scholars have attempted to answer these questions by studying

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[9] Although limited, there are similar studies in architecture (for example Gill, Tierney, Pegg, & Allan, 2010; Janda, 2009; Moezzi & Janda, 2012).

behavioral change through products and systems design and have formed the growing area of Design for Sustainable Behavior introduced below.

2.3. Design for Sustainable Behavior

Fueled by an acknowledgement of designers' ability to influence and alter people's behavior, design researchers in industrial design developed Design for Sustainable Behavior (DfSB) as an area of research and design. DfSB is "an emerging activity under sustainable design which aims to reduce the environmental and social impacts of products by moderating users' interaction with them" (Lilley & Lofthouse, 2010b, p. 55). Different DfSB researchers have proposed design solutions to influence behaviors including laundering[10], cooking[11], showering[12] and energy conserving[13] achieving up to 30% of savings in some cases[14] (for a review of case studies refer to Daae, 2014).

DfSB scholars embrace knowledge from multiple theoretical fields and advocate a user-centered design process while proposing and selecting behavior-changing strategies that vary in their forcefulness. Theoretical fields, strategies and design processes may arguably be considered three main components[15] of DfSB along with design tools[16] and are discussed accordingly below.

2.3.1. Theoretical Fields

DfSB scholars have embraced theoretical insights and contributions from various fields (Pettersen & Boks, 2009) in order to address complex issues related to design and all level of sustainability (environmental, economic and social). Pettersen and Boks surveyed DfSB scholars and asked them to rate 20 theoretical fields based on the extent to which they believe these fields would be most influential for the future of DfSB. Among the top 10 rated fields were: user-centered design, sociology of consumption, psychology and persuasive technology. These four fields are echoed in prominent PhD studies that have contributed to the growth of DfSB. For example, user-centered design was discussed by Daae (2014) and Tang (2010), while persuasive design was part of the literature selected by Lilley (2007) and Lockton

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[10] (Lidman, Renström, & Karlsson, 2011; Spencer, Lilley, & Porter, 2013)
[11] (Oliveira, Mitchell, & Badni, 2011)
[12] (de Jong, Balksjö, & Katzeff, 2013)
[13] (Tang, 2010; Wigum, Daae, & Boks, 2011; Wilson, Lilley, & Bhamra, 2010)
[14] (Wood & Newborough, 2003)
[15] Two other components are explored within the questionnaire as well, namely; measuring outcomes of intervention and DfSB ethical implications.
[16] Design tools were not included in this research study, however, they were briefly included in the literature review to provide readers with a holistic understanding of DfSB and the varying contributions it could make to ID education beyond this research.

(2013). On the other hand, the term sociology of consumption used by Pettersen and Boks is often referred to as consumer behavior in most DfSB literature (Spencer, 2014; Tang, 2010), similarly, social psychology[17] is more often referenced as opposed to psychology in its general form (Daae, 2014; Tang, 2010; Wilson, 2013). Another theoretical field that exists within DfSB literature despite not being included in Pettersen and Boks' list is environmental psychology. Environmental psychology is of particular relevance to DfSB within ID and was explored to an extent by Lockton (2013) and more extensively by Steg in a number of publications including Steg, Van den Berg, and De Groot (2013) and Steg and Vlek (2009). The following section will present a brief overview of these five fields and it will then review the area of sustainable building science for its relevance to ID despite its limited presence within DfSB literature. Sustainable building sciences is important to DfSB within ID as it can be employed within ID to achieve sustainable buildings while advanced technologies can help identify unsustainable behavior patterns and measure the success of DfSB interventions applied in a space.

The theoretical field discussed most frequently within DfSB literature is arguably *social psychology* which is used to understand underlying factors[18] that drive behavior. Social psychology offers behavior models that map out social, psychological and contextual factors that influence human behavior (Jackson, 2005). Stern (2000) argued a argued a synthesis of the various models available in social psychology will likely include:

1. *Attitudinal factors* such as personal norms, beliefs, and values.
2. *Contextual factors* that include "broad social, economic, and political" issues such as social influences, government policies, monetary incentives and physical constraints created by "technology and the built environment (e.g., building design, availability of bicycle paths, solar energy technology)" (2000, p. 417).
3. *Personal capabilities* that relate to the knowledge and skill necessary to carry out a behavior
4. *Habits* that may be defined as routinized actions that occur without conscious intention or deliberation and instead rely on mental short-cuts based on past experiences (Cialdini, 2007; Wilson, 2013).

Stern (2000) explained certain factors play a bigger influential role on a behavior than others. He gave the example of an expensive behavior, such as adding insulation to a home most likely being affected by monetary factors, while reducing car usage as arguably affected by public policy and the built

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[17] It is worth noting that within the built environment literature Moezzi and Janda (2012) also identified three of DfSB theoretical fields, namely; social psychology, user-centered design and consumer behavior, among the fields that can contribute to the industry changing unsustainable behavior.

[18] Also referred to as behavioral antecedents by (Wilson, 2013)

environment (the presence of alternative public transportation and the design, safety and walkability of sidewalks). Through identifying the most influential factors, DfSB researchers choose suitable interventions. For example, if a building does not contain operable windows (contextual factor) the behavior of saving energy through relying on natural ventilation cannot be achieved despite a shared environmental belief amongst occupants and their desire to conserve energy (attitudinal factor). Obtaining such an understanding allows DfSB researchers to propose interventions that can be most beneficial[19] and eliminate those that would not[20].

Consumer behavior is another theoretical field that helps DfSB researchers identify underlying motives for behaviors and choices. Consumption, particularly by the world's wealthiest countries, has been identified as a major contributor to environmental deterioration including deforestation, overfishing and animal extinction (Millennium Ecosystem Assessment Board, 2005). It is a complex issue studied across multiple fields including economics, politics, anthropology, cultural studies sociology and psychology (Edwards, 2000). Nonetheless, Wilk (2002) reduced the diverse and complex theories of consumption and behavior into three main categories: individual choice theories, social theories and cultural theories (for a review of these theories from a DfSB author see Spencer, 2014, pp. 13 - 16). In general, consumption is motivated by a desire to meet personal needs, fit in or stand out within social groups, convey status and express identity. Theories of consumer behavior have been used within DfSB by Spencer (2014) who used it as one of the themes explored in his literature to unravel cultural symbolism assigned to consumption in a cross cultural study of laundering behaviors. Similarly, Tang (2010) explored theories of consumer behavior to understand users' motivations for consumption within homes in an effort to reduce the environmental impact of household appliances.

According to Daae, *user-centered design*, the third theoretical field prevalent in DfSB, was first explored in the 1980s "when it became apparent that much insight could be gained by studying users and their interaction with computers when developing new products" (2014, p. 65). This approach places the user at the center of the design process, while the designer assumes the role of a facilitator employing various methods such as interviews, surveys, observations and user trails to identify user needs and improve design proposals (Tang, 2010). Several DfSB authors argued user-centered design, also referred to as human-centered design, is essential to DfSB (Daae, 2014; Wever, van Kuijk, & Boks, 2008). Based on

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[19] Example: specifying operable windows and adding a design intervention that monitors indoor and outdoor temperature and alerts occupants when it is favorable to open windows overcomes the contextual factor and works with the occupants' attitude to conserve energy.

[20] Example: adding signage prompting occupants to *save the planet* or *conserve energy* would yield little to no result as the occupants already have this belief but lack the means (opening a window).

the International Organization of Standardization (ISO) Daae (2014, p. 65) listed six principles of user-centered design:

1) The design is based upon an existing understanding of users, tasks and environments.

2) Users are involved throughout the design and development

3) The design is driven and refined by user-centered evaluation

4) The process is iterative

5) The design addresses the whole user-experience

6) The design team includes multidisciplinary skills and perspectives

User centered design has formed the foundation for a number of DfSB design processes (Lilley & Wilson, 2013; Wever et al., 2008) as further discussed in section 2.3.3.

Lockton described *persuasive technology*, the fourth field evident in DfSB, as the "closest 'established' academic field for work seeking to use design to influence behavior" (Lockton, 2013, p. 54). Studied extensively by Fogg and his team at the Persuasive Technology Lab at Stanford and applied within Human Computer Interaction, persuasive technology is defined by Fogg as "a computing system, device, or application intentionally designed to change a person's attitudes or behavior in a predetermined way" (1999, p. 27). Lockton argued that computer systems are at an advantage as they can be "relentlessly persistent," offer anonymity, are easily tailored to user input and are adaptable to different contexts (2013, p. 54). Fogg introduced a Behavior Model and argued three elements must occur simultaneously for a behavior to happen, namely; motivation, ability and trigger (Fogg, 2009). He argued the model can help designers and researchers identify why persuasive designs fail or excel by uncovering the underlying psychology behind behaviors. The model also helps designers focus their efforts on the element preventing the desired behavior from occurring, be it lack of motivation, absence of ability or a weak trigger (Fogg, 2009).

The fifth and final theoretical field that has been identified by this review as present within DfSB is *environmental psychology*. Steg, with others, argued environmental psychology "examines the influence of the environment on human experiences, behaviour and well-being, as well as the influence of individuals on the environment" (Steg et al., 2013, p. 2). Within the 1950s the field mainly focused on the effect of the physical environment on human behavior, and it wasn't until the 1960s till researchers began focusing studies on environmental issues, particularly the effects of human behavior on the natural environment (Steg et al., 2013). Steg et al. (2013) argued that the beginning of the 21st century introduced a new concern to environmental psychology, namely; changing human behavior to reduce its negative effect on the environment. A number of theories exist within environmental psychology, the two most

relevant to DfSB are: Gibson's affordances and Kaplan's Reasonable Person Model. Gibson's affordance theory (mentioned briefly in 2.2.2) assumes the environment is a composition of elements that suggest to users certain functions and capabilities, namely; affordances (Kopec, 2006). Lockton argued manipulating people's perception of what an environment can or cannot afford can be a useful strategy to influencing behavior (2013). The Kaplans argued people behave in a manner that responds to their environment and its cues. In their Reasonable Person Model the Kaplans (2011) suggest people are capable of great good and reasonable behavior as long as their environments provide them with the necessary information and support in a clear and consistent manner[21]. This is particularly important for DfSB within ID because it suggests applying DfSB strategies in interior spaces can have dramatically positive results as, according to the Kaplans, people are naturally willing to behave in a sustainable manner if their environments support them.

As mentioned previously, *sustainable building systems* and their impact on sustainability is a topic of particular importance to ID and can be useful for applying DfSB with ID. Sustainable building systems can be divided into two approaches: active and passive (Chen, Yang, & Lyu, 2015). Active design involves employing advanced technologies to refine and increase the efficiency of heating, cooling, lighting, ventilation and hot water production, while passive design uses the building envelope, orientation, shape and layout to achieve efficient buildings (Chen et al., 2015). Although multiple studies have demonstrated the impact of occupant behavior on sustainability (section 2.1.2) researchers argued this should not decrease the importance of creating technically sustainable buildings (Gill et al., 2010), instead, building systems and behavior should be considered simultaneously. One attempt at this can be found in Gill's work with his colleagues (2010) as they proposed a post-occupancy method that accounts for the impact of occupant behavior along with "other building performance mandates" (p. 505). It may be argued that this careful consideration and application of sustainable building systems can increase the success of a DfSB strategy in interior space. Additionally, as demonstrated in Crane's (2008) study (section 2.2.1), building system courses are one of the courses that often include sustainable design which suggests that one way DfSB can be integrated into ID curricula may be for it to latch onto topics already existing within building system courses. This study examines the extent to which this may be the case.

Having provided a brief overview of prominent theoretical fields within DfSB literature, the section below will explore DfSB's second component: strategies.

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[21] For example: If a door handle suggests the door should be pulled open when in fact it is designed to be pushed open a person may find this frustrating and may slam the door or bang it, an entirely unreasonable behavior, yet perhaps understandable.

2.3.2. Strategies

In order to influence behavior, multiple individuals and groups within product design proposed a number of strategies that vary in their forcefulness (Bhamra, Lilley, & Tang, 2011; Elias, Dekoninck, & Culley, 2008; Lidman & Renstrom, 2011; Lilley, 2009; Lockton, Harrison, & Stanton, 2010; Tromp, Hekkert, & Verbeek, 2011; Wilson, 2013; Zachrisson & Boks, 2012). Strategies are typically arranged on an axis of influence. First proposed by Lilley (2007), the axis of influence has been widely adopted and adapted resulting in several iterations. Wilson (2013) summarized the contributions of different DfSB authors in Figure 3, nonetheless, all authors follow the same basic layout where on one end of the axis, strategies provide *users* with full control over their own behaviors by merely assuming the rule of guidance. However, on the polar opposite side, the strategies bestow *products* with control over user's behavior through methods such as automation[22].
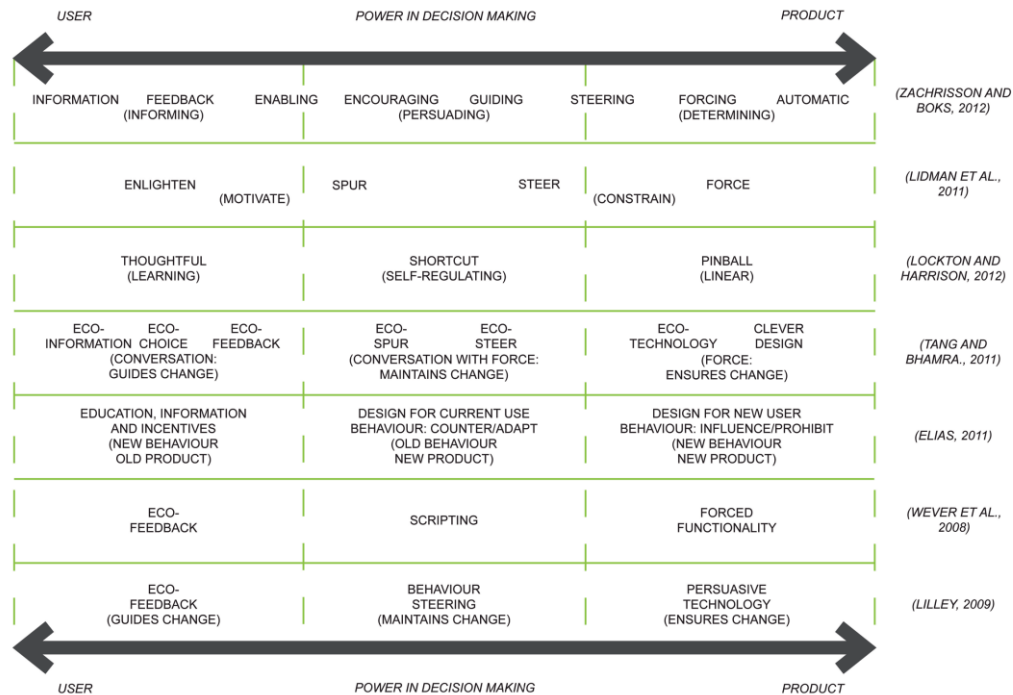
Figure 3 - Strategies represented against the Axis of Influence (from Wilson, 2013, p. 44)

In Zachrisson and Boks (2012) version, strategies are collated under three main categories: informing, persuading and determining, with each category containing a number of sub-categories within it (see Figure 3). As an example, feedback, a sub- category of *informing*, provides users with a "visual, tactile, or

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[22] These design strategies ensure the desired behavior occurs automatically with little or no attention or effort contributed by the users, for example, some hotel key cards control the room electricity and must be placed in a particular slot for the power to come on in the room. Once a guest decides to leave, they remove the key from its slot automatically shutting off all electricity in the room saving by which energy without occupancy effort or consent.

aural indicator in order to inform the user as to their actions" (Wilson, 2013, p. 45). Such strategies merely provide users with information allowing them to determine whether or not they wish to adjust their behavior. Automation on the other hand, a sub-category within *determining*, ensures the desired behavior occurs automatically with little or no attention or effort contributed by the users. Thus, automation falls on the end of the axis that gives the product power to determine behavior. Figure 4 below provides a number of additional examples.
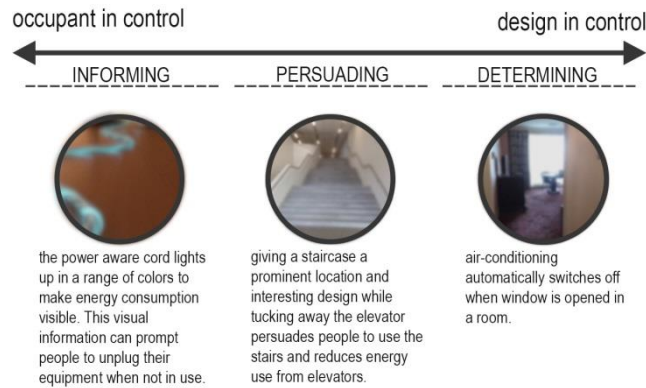
Figure 4 - Examples of DfSB strategies arranged along Zachrisson et al.'s version of the axis of influence

Although some researchers have employed only one strategy at a time (Wilson, 2013) others believe that the application of more than one strategy is required for an intervention to be more effective (Lilley, 2009). It is worth noting however, that applying a strategy that is too forceful may be considered unethical (as discussed in section 2.4) and may be met with resistance and rejection by users (Brey, 2006; Lilley & Lofthouse, 2010b). On the other hand, relying on information and persuasion alone may not bring about any result (Lilley & Lofthouse, 2010b). Interviews with a sample of faculty members will discuss the varying types of DfSB strategies and their applicability in ID (5.3.1).

2.3.3. Design processes

Several authors have dedicated research to developing a design process for DfSB including Selvefors, Pedersen, and Rahe (2011); (Tang & Bhamra, 2009, 2011; Zachrisson, Storro, & Boks, 2011). Lilley and Wilson (2013) reviewed these models and argued they mostly follow the structure outlined in Figure 5.
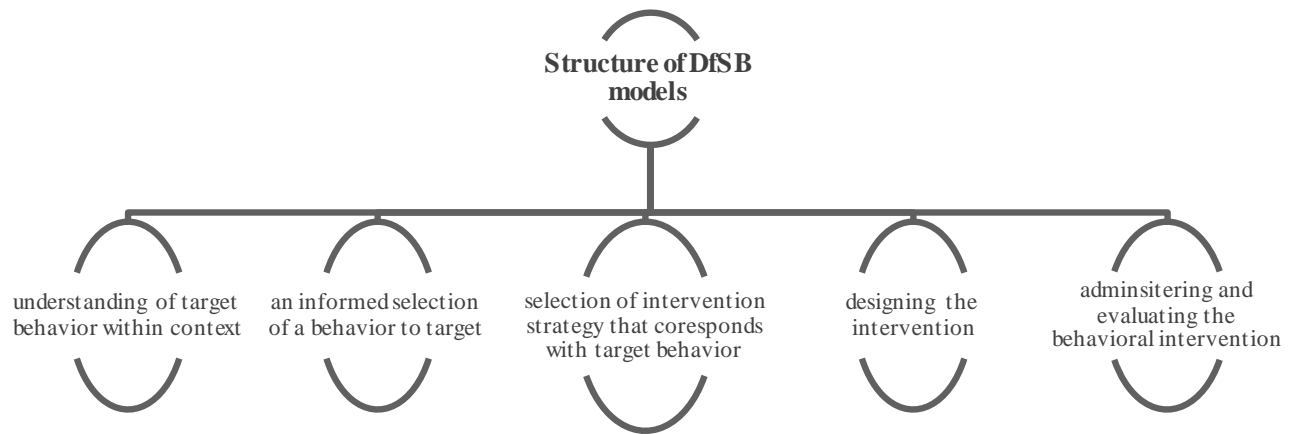
Figure 5- summary of the structure Lilley & Wilson argued is prevalent in most DfSB design processes (2013, p. 284)

The synthesized design processes begins with understanding the user and the internal and external factors that influence their behaviors. Next, a designer would choose the behavior most appropriate for targeting, normally one that is most feasible and can have a big impact if changed (Steg & Vlek, 2009). From the growing list of strategies available (discussed in section 2.3.2), designers can select those they feel best produce the desired behavioral change. A complete intervention[23] is then designed, administered and finally, assessed.

Lilley & Wilson's review (2013) also identified the limitations of the current DfSB design process:

1. The evaluation phase is limited to the very end of the process without indicating how to use information from evaluation and feed it back into the process.
2. Ethical considerations are not integrated.
3. A criterion through which designers can appropriately match strategies to behaviors is lacking

To address these limitations, the authors proposed an enhanced design process comprised of five stages "using user-centered design as its foundation" (Lilley & Wilson, 2013, p. 290). In this model, feedback is trickled back into the process and ethical considerations integrated at various points.

As mentioned earlier, user-centered design plays such a fundamental role within the DfSB design process that some authors positioned DfSB as a sub-direction within user centered design (Daae, 2014) and others used user-centered design as one of the foundational elements for their proposed process (Lilley & Wilson, 2013). User-centered design techniques can be used in various phases of the design process, for

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[23] An intervention is defined here as the act of administering DfSB strategies in order to change human behavior.

example, Selvefors et al. (2011) incorporated semi-structured interviews, observations and questionnaires to identify reasons for wasteful energy consumption. Similarly, in his study of oral health behavior Zachrisson et al. (2011) employed "overt observation, covert observation (video recording), cultural probing, survey, generative sessions, and a blog analysis" (2011, p. 364) to study oral health care (target behavior) and the factors affecting it. Incorporating user-centered design techniques during the evaluation phase of a design process was also stressed by Lilley & Wilson (2013) in discussing their proposed process. This study will examine the presence of these theoretical fields in ID education and faculty members' evaluation of their importance to ID.

DfSB authors have also investigated ways of making the design process understandable and accessible to other designers and have proposed a number of design tools to that effect, discussed briefly below 2.3.4.

2.3.4. DfSB design tools

Lockton's (2013) Design with Intent toolkit collated a hundred applied examples of behavior change strategies and arranged them within six lenses (persuasive, visual, cognitive, security, architectural and error-proofing). He tested the toolkit with a number of designers, students and stakeholder addressing both environmental and social design briefs including the use of kettles efficiently, turning off the tap while brushing teeth, and wearing layered clothing in offices to reduce heating needs (Lockton, 2013). Wilson (2013) argued the Design with Intent toolkit can successfully introduce those with no previous exposure to DfSB such as students and clients, to the area. He also argued the Design with Intent toolkit is useful for facilitating discussions and brainstorming ideas, however, it does not outline a process for understanding the antecedents of a behavior (factors influencing behavior) or its context. Wilson anticipated this could cause a design to fail in achieving its goal due to misunderstanding the underlying causes of a behavior (2013).

Zachrisson addressed this by offering a tool to help designers make informed decisions about the interventions they propose for changing behavior. His work expanded on that of Tang and Bhamra (2009, 2011) and incorporated an understanding of behavior antecedents (factors identified by social psychology such as: habits, intentions, values, norms and constraints) to define a target behavior and appropriate design strategies. Wilson argued Zachrisson's tools unravel the aggregate factors affecting behavior so that designers can understand the impact of each factor on the behavior and choose the appropriate strategies for changing it (Wilson, 2013). Despite having overcome one of the main critiques laid at Lockton's Design with Intent toolkit discussed above, Zachrisson's tool is presented with its own challenges. When applying the tool to a case study targeting oral health care for a group of users, it was found that individuals within the group were influenced by different behavior antecedents. The tool does

not present guidance on how to account for these varying behavior antecedents and relies instead on the designer to decide which antecedent is most prevalent / important.

Although design tools were not directly examined by this research, they are an important part of DfSB and were therefore included in this review to demonstrate the breadth of the field and what it can offer to ID. Although integrating DfSB into ID is beyond the scope of this research any future efforts for integration would benefit greatly from examining these tools and their use in industrial design as a starting point from which to develop tools more specific to ID.

2.4. Ethical Considerations within DfSB Literature

According to Papanek (1985) "design has become the most powerful tool with which man shapes his tools and environment (and, by extension, society and himself)". This demands "high social and moral responsibility from the designer" (p. ix). Similarly, Berdichevsky and Neuenschwander (1999) argued design, whether intentionally or unintentionally, influences people's behaviors. Influence through design is therefore not unique to DfSB; what is unique is that DfSB *intentionally* aims to change people's behaviors to meet a predetermined goal set by a designer (Wilson et al., 2010).

Although ethics in relation to DfSB are widely discussed in DfSB literature (Lilley & Lofthouse, 2010a; Lilley & Wilson, 2013; Manzini, 2006; Pettersen & Boks, 2008; Tromp et al., 2011), "a structure or criteria by which to ethically rank" (Lilley & Wilson, 2013, p. 285) and choose strategies, is lacking. Researchers are nonetheless, carefully treading through and around the topic of ethics with a collection of governing principles as their guide.

When discussing ethics within persuasive technology, a theoretical field relevant to DfSB as established in section 2.3.1, Fogg (2003) argued it is possible to assess the ethical implications of a persuasive technology by examining the *intentions* of designers and organizations that created it, the *methods* they used and the *outcomes* of the technology. Intention, according to Fogg, is "what designers hoped to accomplish" (p. 220) with the product they created and can either be ethical, unethical or questionable. For instance, promoting health and safety practices can be highly ethical, while promoting smoking is arguably unethical. Other intentions are not as easily categorized; Fogg uses the example of advertising an eco-friendly car to a group of people who are environmentally conscious. Fogg argued some people may find the car company's intentions to be questionable despite the eco-friendliness of the car. Fogg saw this as the first step for evaluating ethics, he argued if the intentions of a designer are unethical, it is highly likely that the product they create is consequently unethical. His second criterion to assessing ethics was

the method used to persuade people with some methods again being clearly unethical like using force or skewed information. Ethical methods, on the other hand, include demonstrating factual casual relationships that help individuals make good decisions. It is possible for a designer to have ethical intentions while using unethical methods such persuading someone to eat a healthier diet through employing scare tactics (Berdichevsky & Neuenschwander, 1999). Outcome is the third and final measure that Fogg identified. Every design has an outcome and Fogg used Berdichevsky & Neuenschwander flow chart (Figure 6) to explian the levels of ethical responsibility a designer may bear for an unethical consequence of a product or design. Berdichevsky & Neuenschwander distinguished between intended and unintended outcomes of a persuasive technology. If an outcome of a persuasive design is that which the designer intended and has an ethical purpose then the designer is worthy of praise for their acheivement. On the other hand if the outcome of a design is not what the designer intended, was reasonably predictable and unethical then the designer is at fault.
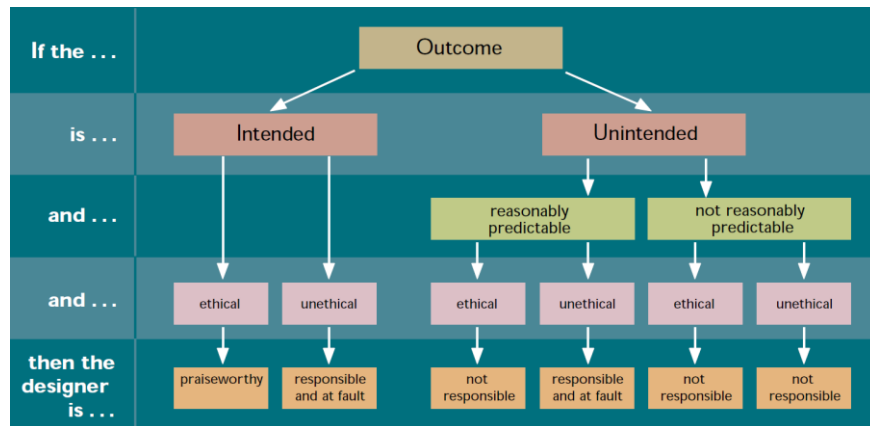
Figure 6- Flow chart clarifying a designer's levels of ethical responsibility from (Berdichevsky & Neuenschwander, 1999, p. 55)

For example, although it has become relatively common knowledge that park benches with arm rests in the middle are used to deter the homeless from sleeping on these benches (Swain, 2013), before the motive behind this was revealed, some landscape architects may have used these benches in parks without anticipating such an outcome. Deterring homeless from sleeping on park benches would fall into the category of an unintended outcome that could have reasonably been predicted on the part of the landscape architect. Depending on who you ask, this outcome is arguably unethical, nd accordingly based on Berdichevsky & Neuenschwander's flow chart, the landscape architect is at fault.

Berdichevsky & Neuenschwander (1999) presented eight "ethical principles of persuasive design" including what they consider to be the "golden rule" (p. 52) of persuasion, namely that designers "should never seek to persuade anyone of something they themselves would not consent to be persuaded of"

(Berdichevsky & Neuenschwander, 1999, p. 58). These ethical principles are often cited in DfSB literature (Daae, 2014; Lilley, 2007; Tang, 2010; Wilson, 2013) and were outlined by Berdichevsky and Neuenschwander (1999, p. 52) as follows:

1. The intended outcome of any persuasive technology should never be one that would be deemed unethical if the persuasion were undertaken without the technology or if the outcome occurred independently of persuasion.
2. The motivations behind the creation of a persuasive technology should never be such that they would be deemed unethical if they led to a more traditional persuasion.
3. The creators of a persuasive technology must consider, contend with, and assume responsibility for all reasonably predicted outcomes of its use.
4. The creators of a persuasive technology must ensure that it regards the privacy of users with at least as much respect as they regard their own privacy.
5. Persuasive technologies relaying personal information about a user to a third party must be closely scrutinized for privacy concerns.
6. The creators of a persuasive technology should disclose their motivations, methods, and intended outcomes, except when such disclosure would significantly undermine an otherwise ethical goal.
7. The creators of a persuasive technology should disclose their motivations, methods, and intended outcomes, except when such disclosure would significantly undermine an otherwise ethical goal.
8. The Golden Rule of Persuasion. The creators of a persuasive technology should never seek to persuade a person or persons of something they themselves would not consent to be persuaded to do.

Interestingly, architecture and its influence on behavior is sometimes featured in DfSB literature primarily by Lockton (2011, 2013) and briefly by Wever (2012). In his discussion of ethics, Wever mentioned the Dutch architectural movement as an instigator to ask: "what right designers have to intentionally influence and/or educate the users" (p. 2). According to Wever, the Dutch movement roughly took place between 1915 – 1930 and is now referred to as "expressionist architecture" (p. 2). Wever cited Venema and presented a catalogue excerpt from an exhibition about the Amsterdam School. This excerpt described the design of working-class dormitories and the role the design can play in *educating* the occupants (Landré, 'De Moderne Woninginrichting', Amsterdam, 1914, cited in Venema 1975, translated from Dutch by Wever, 2012):

> One teaches the working class how to live. One teaches them where their table should be placed, where their lamp should be hung, where their bed should stand. And in order to really imprint this on the disobedient, one places the window in the corner, to ensure that the table will be placed

there and definitely not in the middle of the room. One screws the lamp hook eccentrically in the ceiling, to ensure that the lamp will not be hung in the middle of the room, and one fixes the bed in a particular corner to ensure that the working class man takes his 8 hours of sleep there, and not where-ever he might prefer himself.

Wever also shared more examples from Venema including an architect's decision to make kitchens too small so that the working class tenants cannot use it as a living space and positioning windows high enough to deter "women folk" (Wever, 2012, p. 2) from chatting with their neighbors.

It may be argued that such a "paternalistic" (Wever, 2012, p. 2) approach is no longer prevalent in architecture and ID today, at least not as overtly. Nonetheless, these examples support Fogg's argument that stressed the importance of intention within design as it demonstrates that an ethical outcome does not necessarily justify any means (methods). Although the examples above are probably shocking to many contemporary readers, it is possible the architects at the time felt their designs were justified because their goal was to *educate* and ultimately better the occupants' lives. This is relevant to DfSB because it demonstrates that despite DfSB's aim to improve the state of society, economics and environment, the question of: *what does this ethical goal justify,* still requires an inherently thoughtful and nuanced answer.

Researchers within DfSB are slowly attempting to identify ways through which to achieve societal and environmental goals by ethically influencing individuals' behaviors. Attempts are also underway to include ethical considerations as an integral pieces in the DfSB design process as mentioned earlier (section 2.3.3) within Lilley and Wilson's work (2013). This research's findings on ethics are discussed in section 5.5.

2.5. Industrial Design Education: Integrating DfSB and Social Sustainability

Within the context of education, DfSB literature explored three main topics: 1) teaching methods and material for DfSB, 2) addressing social behaviors through the use of design and 3) teaching ethics within DfSB. These three topics are reviewed below.

Lilley and Lofthouse (2009) noted that within industrial design education at Loughborough University sustainable design is taught through "a blend of lectures seminars and workshops, supported by a range of web-based resources" (p. 30). Using these teaching platforms, the authors explored specific methods for teaching DfSB (through two studies) and developed a web-based resource that contains material specific to DfSB. The first study started with an introductory lecture that introduced MA/MSc students to DfSB by presenting examples of product-led interventions for changing behavior. Students were then tasked to redesign a particular product (a mobile phone that reduces the social impact of its use in public) while

keeping a logbook for their "ideas, thoughts and analysis" (p. 31). At the time of that study, Lilley noted that DfSB research was limited in industrial design which meant there were few examples available to help illustrate the application of behavior change. Additionally, the few examples that did exist did not explain the research or process that led to the design. Another challenge was that many of the examples available were from other disciplines and contained "field-specific terminology not readily used or understood within the context of industrial design" (p. 32). The second study (carried out by Lilley and Tang) consisted of a lecture focused on the environmental impacts of refrigerator usage in households. Students were provided "with background contextual information, an overview of design for behavior change approaches and product case studies illustrating how others had used these approaches" (p. 32). Lilley noted that unlike the first lecture, in this second one, theories were more clearly illustrated through relating them directly to sustainable product design which made them understandable and engaging for students. From conducting these two teaching studies, Lilley identified the need for a centralized location containing information on DfSB and in response developed the www.design-behaviour.co.uk website. The website went through iterations to ensure it included all relevant information and was understandable and intuitive.

The methods through which sustainable design is taught within Loughborough University are similar to the methods Crane (2008) found are often used in ID and were therefore included in this research's questionnaire. Additionally, the challenges Lilley faced when preparing and administering the lectures (namely; limited examples, vague explanation of process and terminologies specific to fields other than her own) could arguably be faced by interior design faculty introducing DfSB to ID for the first time and consequently were also used in the question relating to barrier within this research's questionnaire. These two commonalities make Lilley and Lofthouse's experience a valuable learning reference for ID faculty and will therefore be reflected on in the discussion in chapter 0.

Watkins (2013) and Lofthouse (2013) noted environmental aspects of sustainability are being covered in universities to encouraging degrees, unlike social aspects of sustainability. In response, Watkins (2013) dedicated his PhD work to exploring "methods for encouraging and enabling students to address the social aspects within sustainable product design" (p. iv). Through a questionnaire and interviews with industrial design faculty members, Watkins explored how widely social issues are taught, which aspects are discussed and how they are taught. Based on these findings, Watkins developed three workshops that he tested at five universities. During these workshop, students were introduced to the social aspects of sustainable product design through "group work, discussions and critical reflection" (p. iv) which Watkins believed led to critical thinking and deep learning. Similar to Crane's findings in ID, Watkins' (2013) study in industrial design also revealed that integrating sustainability into the curriculum and in

studio projects presented students with a more holistic and contextualized understanding of sustainable design as opposed to a segmented one. This was to overcome the same challenge identified by Crane's study, namely; students' tendency to compartmentalize learning. Both findings, students' tendency to compartmentalize and the benefits of integrating a topic into the curriculum and overcoming this tendency will be examined further by this research (7.1.1).

Lofthouse on the other hand developed and tested a series of Design Issues Cards for students. To create the cards Lofthouse relied on extensive literature reviews, questionnaire, interviews and a peer review workshop. After a number of iterations the social cards (consisting of an example on each card with an image on one side and explanatory text on the other as demonstrated) were tested with students engaging in a sustainable design project. Observations showed 1) students used the cards sporadically through the design process, 2) the cards inspired discussions amongst groups, and 3) examples inspired some groups to look for further information online. Students commented they liked the cards and found them inspirational and relevant. Although not used by this research, these social cards may be relevant for future work on integrating DfSB into ID.

The final area discussed within DfSB education is the notion of ethics (discussed in detail in section 2.4). Lilley and Lofthouse (2010b) integrated an ethical discourse into a pilot study to test teaching material regarding the topic. The pilot used a range of "methods including; tutorials, group discussions, case studies, ethical checklists and matrices" (p. 65). The pilot presented the following findings:

1. Different methods yielded different success rates, discussions for instance were found to be valuable in encouraging students to define and defend their views.
2. Participation varied greatly based on student ability and inclination to vocalize their views and a relatively substantial amount of prompting was required to keep discussions flowing. To overcome this, the authors suggested asking students to prepare statements and positions beforehand and present them in class.
3. The authors felt embedding ethical considerations into a design process was a successful choice as it allowed students to tackle the topic along with other design considerations.
4. Lilley and Lofthouse preferred providing students with a checklist of open-ended questions that would prompt reflection and critical thinking instead of using complex matrices.

The authors also identified a number of challenges to delivering the topic of ethics with DfSB, namely; 1) faculty feeling unqualified to teach the topic due to lack of previous knowledge and 2) students' being uncomfortable with the nuances of ethics and preferring faculty provide them with the absolute truth. Lilley and Lofthouse's work is considered further in a alter section (7.1.2).

Watkins and Lofthouse's contributions are an example of different tools used to introduce students to new design concepts and awareness. These can be of great relevance to ID faculty attempting to introduce their students to a new topic (DfSB). ID faculty can experiment with different workshops and explore the benefits of developing a tool similar to the Social Issues cards that contains examples specific to interior spaces and architecture. This research will ask ID faculty members to propose methods through which to teach DfSB in ID.

2.6. Gaps in knowledge

Although research into user behavior's impact on sustainably designed buildings is increasingly growing, interior designers' contributions are still relatively limited in quantity and content. Nonetheless, two authors have contributed to the topic within interior design and have laid a sound foundation for future work. Their contributions, however, were limited to increasing occupant education and engagement either through encouraging interior designers to assume an occupant advocacy role within the design/building team (Sorrento, 2012) or through including the occupant in the design process (Theodorson, 2014). These strategies are arguably beneficial; except they do not encompass the breadth of methods available for changing behavior nor do they take advantage of the literature the authors cite from social psychology and similar fields. There is a need to address this gap in ID work through building on available theories, strategies and processes from aligned design fields like DfSB.

Both authors discussed the importance of educating students on the relationship between sustainable design and behavior, however, neither thoroughly examined the current educational landscape nor proposed guidelines to engaging students in this topic[24]. Literature has demonstrated an increased focus on sustainable design education within ID; however, the prevalence of behavior courses and their link to sustainable design within education has not been widely explored or documented. This presents a second gap in ID literature, particularly in regards to education, which was also examined by this researcher through reviewing the course contents of top ranking ID programs (3.2.1) and asking ID faculty (via a questionnaire) whether they tackle these two topics simultaneously in their courses.

DfSB has, for the most part, been applied within the context of products and systems and by experts within these fields (excluding Lockton, 2013 who intentionally tested the DwI tool with professionals from a number of disciplines including architecture). Multiple studies engaged experts in discussions

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[24] Theodorson discussed the benefits of an interdisciplinary education for ID students along with expanding environmental system courses to include behavioral issues, but did not provide further explanation.

around DfSB (Daae, 2014; Lilley, 2007; Lofthouse, 2013; Watkins, 2013); the experts however were largely associated with product/industrial design and similar fields. Exploring DfSB within a different context, namely; ID can arguably provide critical insights and contribute to DfSB's growth beyond products and systems. Documenting ID faculty's evaluation of DfSB can help to validate it and highlight any concerns or challenges to adapting its theories, strategies and processes into other design fields.

3. Methodology

This chapter will outline this research's design through discussing the three research stages, followed by an exploration of research validity, reliability and generalizability.

3.1. Research Methodology

Both quantitative and qualitative data collection methods were used to answer the research questions (section 1.3) however it may be argued that this research is predominantly qualitative due to its focus on capturing the varied views and opinions of ID faculty. Additionally, quantitative data was presented numerically and graphically when appropriate and a descriptive analysis provided. Using a mixture of methods is not uncommon within qualitative research (Robson, 2011) and can strengthen research by overcoming the inherit biases and shortcomings of one method by using another alongside it (Creswell, 2009).

Qualitative research adopts a constructivist worldview[25] which believes meaning and reality do not exist independently; rather are created and constructed through human interactions and experiences (Robson, 2011). As such, qualitative research studies the complex meanings and views of participants through broad and open-ended questions and the collection of non-numerical data. The researcher is considered an instrument for data collection (Robson, 2011) and should therefore be aware of biases he or she brings into research.

On the other hand, quantitative research is guided by a post-positivist worldview that believes reality is objective and exists detached from the researcher (Robson, 2011). Quantitative research employs structured experiments or quasi experiments within controlled settings (labs) that explore correlations and specific causal relationships amongst variables (Creswell, 2009). Creswell focuses on two strategies within quantitative research, namely; survey and experiments. Surveys are useful for providing numerical and generalizable understandings of a population's beliefs, attitudes and opinions by studying a representative sample while experiments are concerned with testing the impact of a treatment on a situation or population (Creswell, 2009).

In this research, quantitative data collection methods such as surveys provide a broad understanding of the status of DfSB within ID through capturing faculty members' beliefs, attitudes, opinions and knowledge on the topic. Additionally, qualitative methods (interviews) allow for the in-depth exploration of faculty

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[25] Worldviews are "set of beliefs that guide actions" (Guba, 1990, p. 17).

views on DfSB's current state along with their suggestions for improving it. An overview of the methods used in this research is explored in the following section.

3.2. Overview of Methods

The research design began with a qualitative strategy, a review of prominent ID programs, followed by a quantitative study, a questionnaire targeting ID faculty, and finally with another qualitative method involving faculty interviews. The sequence chosen for the methods was deliberate as the review of ID programs helped concentrate the questionnaire's scope and the questionnaire acted as an educational tool that ensured all faculty members who answered it became on the same level of familiarity with DfSB allowing them to accurately respond to interview questions that tackled questions that required critical reflection.

3.2.1. Review of Documents: interior design programs

This method investigated whether leading interior design programs' indicated, through their online material, that they teach students how to use design to encourage sustainable behaviors.

3.2.1.1. Sample

Design Intelligence publishes an annual report ranking "America's Best Architecture and Design Schools." This ranking is often used by universities and programs on their websites as marketing material to enhance their appeal to incoming students. Design Intelligence provides an overall ranking for the top ten programs along with sub-rankings based on skill area one of which is "sustainable design practice and principles" (DesignIntelligence, 2014). This research used an amalgamation of both lists: top interior design programs in 2015 and top programs offering sustainable design for the same year resulting in a total of 12 programs.

3.2.1.2. Method and analysis

The official websites of the top 12 undergraduate interior design programs were examined in search of evidence linking design, behavior and sustainability in ID education. Analyzing website content as a research method has been successfully used in investigating sustainable education in design programs, particularly, industrial design (Ramirez, 2006, 2012). Programs' overview pages along with supporting PDFs including curriculum and course descriptions were downloaded and analyzed creating an *audit trail*

which Robson indicated increases research validity (2011). A keyword search was carried out on all documents searching for a mention of 1) sustainability and 2) behavior; if these words were not found then words and phrases such as 3) environmental/environment and 4) human factors were looked up. When these words were found in a text, the words' contexts were analyzed in search of an indication that *design is intentionally used to encourage sustainable behavior.*

Code	Description
YES	The key word is explicitly mentioned either in course title or description
NO	No mention of the keyword

Table 2- code for analyzing ID programs

A coding system based on Ramirez's work investigating sustainability in industrial design education was adopted in this study illustrated in Table 2. The code documents the presence of the key words above along with signs of a relationship amongst them in 1) program overviews, 2) lecture courses, and 3) studio courses. The last area is where this study differs from Ramirez's as her third category was student work not studio projects; this is because the researcher found large discrepancies in the amount and content of student projects published by each program. Some programs only published a small amount while others only provided images of projects with no supporting text. As such, student work was not viewed as a reliable or indicative source of data for this review.

3.2.2. Questionnaire: interior design faculty

Through administering a nationwide questionnaire to ID faculty members, this method provided an overview of the current state of DfSB within ID programs.

3.2.2.1. Limitations of questionnaires as a data collection method

Robson identified a number of disadvantages to using questionnaires as a research method. These disadvantages and the manner in which they were overcome in this study are outlined in Appendix 8.1.

3.2.2.2. Distribution and structure.

Personal email invitations were sent through Qualtrics to members of the Interior Design Education Council affiliated with U.S. institutions. The questionnaire was comprised of 12 questions followed by a demographic section. To form a comprehensive understanding of DfSB's current state in interior design education, faculty that indicated DfSB is taught in their program either explicitly or implicitly were asked to answer an additional 6 questions. All questions were quantitative multiple choice questions, however,

many of them were followed by an open-ended question that allowed respondents to comment or elaborate. In two questions faculty were given the option of providing their own answer by selecting "other" and filling out a comment box.

3.2.2.3. Pilot studies

The questionnaire went through two stages of piloting; the first elicited feedback from two interior design faculty members within Virginia Tech and the second phase included seven participants from different institutions. The only criterion for selecting participants for the pilot was that they be interior design faculty regardless of association with IDEC. During the first stage the researcher was present with volunteers as opposed to the second phase which was a mixture of in person and email interaction. Through an email invite, volunteers were asked to provide feedback on the questionnaire's "length, clarity and understandability." Feedback was positive with faculty indicating the questionnaire itself was a learning experience. Valid concerns however were raised in the first phase in regards to length (averaging about 30 min) and repetitiveness of questions. This was addressed in the second phase which reduced the survey completion time to between 13 and 18 minutes by removing questions that were too similar or did not provide meaningful insights.

3.2.2.4. Analysis

The questionnaire was mainly comprised of multiple choice questions providing quantitative findings which were reported in the form of percentages[26]. The open-ended questions and comments were analyzed using coding and clustering uncovering common themes, a method commonly used in qualitative analysis (Creswell, 2009).

3.2.2.5. Main questionnaire sample

A nationwide questionnaire (see Appendix 8.3) was developed and distributed to interior design faculty members. A total of 530 emails were sent to the Interior Design Education Council (IDEC) members' directory, excluding any faculty outside of the US. 10 emails bounced, and 22 were duplicates which resulted in a total of 498 email invites. 278 people started the questionnaire over the course of three weeks, and by the end of that period and two reminder emails, 203 faculty members completed it for an approximate 41% response rate. This response rate is considered relatively high particularly when compared with another study that surveyed the same population yielding a 24% response rate (Crane, 2008).

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[26] Some of the percentages reported may not add up to an exact 100% rather some may show 99% or 101% due to inaccuracies that occur from rounding up numbers to one decimal.
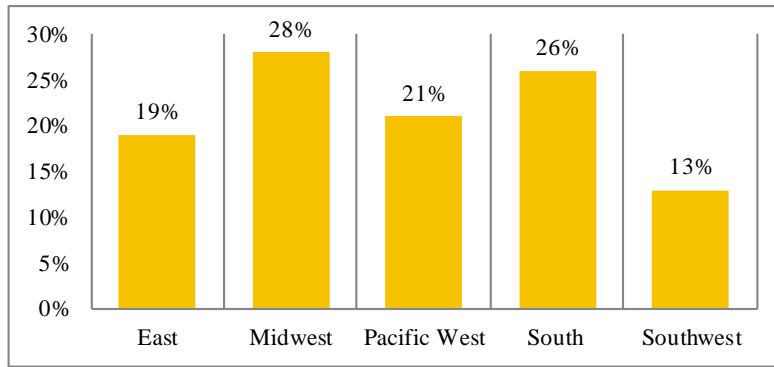
Figure 7- All IDEC regions were represented in the questionnaire results

Responses represented 108[27] universities from all five IDEC regions (Figure 7) with approximately 81% of respondents indicating their programs are CIDA accredited.
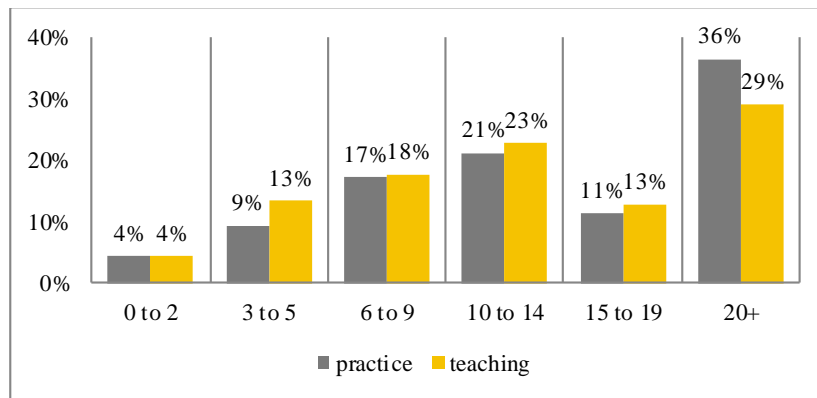
Figure 8- Sample's years of teaching and practice experience

81% (164) of respondents were female while 19% (39) were male. Of the respondents 36% had 20+ years of practice expense and 21% had experience between 10 – 14 years. Similarly most faculty members had 20+ years of teaching experience (29%) followed by 23% of those who had 10 – 14 years (Figure 8). 60 respondents held a PhD, 58% of which had common PhD areas with at least one other respondent. Those areas included architecture (17%), interior design (9%), the social sciences or allied field (23%), and a number of other fields[28] (51%).

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[27] There were probably more institutions represented however, not all respondents answered this question.
[28] These included but are not limited to: design, education, art education, history, American studies, instructional systems and technology.

3.2.3. Interviews: sample from interior design faculty

At the end of the questionnaire, respondents were asked to indicate if they would be willing to volunteer for the interview phase of the study. An email invite was sent to a random selection of the volunteers and a total of eight faculty members (seven females and one male) were interviewed. Table 3 provides a brief description of the interviewees including the code assigned to each faculty member to protect their anonymity, their academic position, which IDEC region they belong to and whether or not they are NCIDQ certified (for further information on certification see 1.7).

Faculty code	Position	IDEC Region	Certification
A	Co-chair – Assistant Professor	South	NCIDQ
B	Assistant professor	Southwest	
C	Assistant professor	South	
D	Associate professor	South	
E	Assistant professor	Midwest	NCIDQ
F	Program Lead	Pacific West	NCIDQ
G	Chair – Assistant Professor	Southwest	
H	Coordinator – Assistant Professor	Midwest	NCIDQ

Table 3 - Characteristics of Interviewees

Interviewees represented all levels of self-identified familiarity with DfSB (see section 4.3.1.1.1 for a description of self-identified familiarity). A consent form was emailed to volunteers prior to conducting the interviews and their verbal consent was provided in the beginning of the interview. Interviews occurred either through Skype or phone and were audio recorded and later transcribed by the researcher.

3.2.3.1. Protocol design

A semi-structured interview protocol was developed based on the findings of the questionnaire. Semi-structured interviews allow the researcher to begin with a set of questions. The order in which they are asked along with the wording may be adjusted based on the interviewee. Additionally, some questions may be omitted or additional ones included (Robson, 2002). The interview was meant to provide both a commentary on the results of the questionnaire along with a more in-depth exploration of this study's research questions (1.3). As such the protocol was organized under three main goals; the first was to provide clarifications on some questionnaire results, second, to collect suggestions on relevant content and appropriate methods for delivering DfSB to ID students and lastly, to explore DfSB applicability in the ID industry and ways of disseminating it.

Robson suggested an interview may consist of a set of questions along with a set of "subsequent items depending on the responses obtained" (2002, p. 274). Below the main questions are numbered with subsequent items listed underneath each one in the form of bullet points. These bullet points were either examples or follow-up questions and they were asked based on each interviewee's response. The interviews were intended to be conversational therefore the protocol's linguistic tone was intentionally casual to make it easier for the interviewer to maintain a conversational flow while consulting the protocol.

A couple of drafts were developed for the protocol and a final draft submitted to the Institutional Review Board and approved. The interview was piloted with two faculty members one in ID and the other from an allied design field[29]. Once the interviews were conducted however a few questions were not consistently asked due to the limited quality of answers and conversation they generated. These questions are not highlighted in bold below:

1. **Could you tell me a little about yourself?**
   - Position / Courses (Contain sustainable design/Behavior/DfSB?) / Involvement in curriculum development

2. **Can you speak a little about DfSB?**
   - When/how did they first learn of it? / Meaning / Strengths and challenges

3. **From my review of prominent institutes' curricula and course descriptions, I was not able to find any mention of DfSB or intentionally changing behavior towards sustainable behavior. Do you know why this is the case?**
   - Example: Implied / Too specific to be included? / It is no different than sustainable design or behavior courses?

4. **The survey showed very few faculty were able to accurately define DfSB and speak about its origins or prominent literature; why do you think this is?**
   - In the survey one main reason was faculty lack knowledge; would you agree?
   - How can we overcome this/motivate faculty to learn about DfSB?

5. **In industrial design literature concerning DfSB, one of the reasons user-centered design is advocated is to reduce the risk of making unethical design proposals. It seemed very few ID faculty believed using DfSB would present an ethical didactic, why do you think this is the case?**
   - Examples: interior designers effect behavior all the time / DfSB encourages positive behaviors

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[29] This pilot was conducted over skype to provide the researcher with experience using this medium for interviewing.

- Do you think DfSB researchers in industrial design are overly concerned with this ethical discussion in DfSB?

6. **Let's talk a little about incorporating DfSB into ID education; how crucial do you think DfSB is to ID practice and education?**
   - Do you think it is adequately incorporated in your ID program? How?
     - o Examples: As a pillar of interior design (as important as studying materials and colors, for instance), senior elective, other?
     - o Are there any existing courses within your program that are already or can be easily modified to offer DfSB?
   - And how do you think it should be offered within a theoretical frame (like social aspects in design), or within studios in a way similar to addressing functional aspects in design? Both?

7. **DfSB is inherently interdisciplinary and relies on knowledge from multiple areas; how do you think this can best be taught in ID courses?**
   - Examples: ID faculty learn and teach DfSB theoretical fields versus faculty from other departments teach these theoretical fields / Co-teaching courses with faculty from psychology, industrial design, architecture, engineering and ID

8. **What are some challenges to incorporating DfSB into ID? And how can we overcome them?**
   - Example: Requires a shift in what we believe ID should accomplish / Overcrowded curricula / Too many prerequisites necessary for DfSB / ID programs don't focus enough on the theories prominent in DfSB / Too many CIDA requirements to meet already / no literature specific to ID

9. Do you think DfSB can be incorporated into ID to help institutes meet CIDA standards, or is it not in-line with CIDA? Please explain.

10. Do you believe there is a difference between applying DfSB using products and applying it using spaces?
    - Examples: Privacy/control/time/

11. **We discussed user-centered design earlier; do you think using this process is feasible in ID when applying DfSB?**
    - Is there enough access to occupants in all stages/prototype testing/ID students training in interacting with occupants?

12. **Can we use the same DfSB strategies from industrial design or do you believe they need to be modified to better suit ID? How? Are some inherently more suitable for ID then other?**
    - Examples: Control/develop examples specific to ID

13. Would people be more accepting and susceptible to adjusting their behavior in certain building types versus others? (K-12, healthcare, workplace, retail)

14. Which elements of the space effect behavior the most and how? Can you think of examples?

- Spatial layout (where things and spaces are located in relation to each other- proxemics), furniture layout, materials, building systems, signage, products etc.

15. **Some of the main challenges within DfSB are identifying which behavior to target and how to measure the effect of a design intervention. How do you think these may be achieved in ID?**
    - Examples: Collaboration with engineers/better training in user-centered design

16. **What are some selling points that designers can use that would excite clients about DfSB in ID?**
    - More often than not, monetary savings are important to clients, so what savings can DfSB bring?
    - How do you think interior designers can demonstrate these savings to clients?

17. **How do you see DfSB working with LEED?**
    - Examples: part of LEED/beyond/within creative credit/occupant engagement/support decision processes as to which credits to pursue.

3.2.3.2. Analysis

Interviews were recorded upon approval from the interviewees and fully transcribed. From the transcription a summary was created and sent to interviewees for member checking which enabled faculty to check their responses and make adjustments or clarifications if they desired.

Coding is the most prominent method for analyzing qualitative data as identified by Flick (2007). This method was also used by Watkins (2013) and a coding system similar to the one he used in his research was adopted here. Creswell (2009) advises deriving codes after conducting an overview reading of a few transcripts first and then taking these codes to the rest of the interviews and making adjustments to them as needed. Sections that had similar codes were copied and pasted into separate documents creating the following major themes:

- Barriers and remedies to DfSB integration
- Assessment of DfSB and its examples with ID education
- Curriculum suggestion of content and teaching methods
- The role of industry and academia in shaping ID education
- Disseminating DfSB into industry and academia
- Ethics

These six major themes constituted the 1st level of codes and contained underneath them a 2nd level and in certain cases a 3rd. Watkins (2013) argued providing this 3rd level allowed for greater levels of detail to be

captured in the coding and included in the analysis. For example, the following code: *Bar – Fa – Bel*, refers to a *barrier* that relates to *faculty* and their *belief* in DfSB. The table below explains the three levels contained within this code:

Bar	Fa	Bel
1st level	2nd level	3rd level

Table 4 - An example of the three levels of codes used in interview analysis

As an example a full list of the *barriers and remedies codes* can be found in Appendix 8.4 along with a *coded summary of an exemplar interview transcript* in Appendix 8.5.

3.3. Reliability, Validity and Generalizability

Creswell discussed a number of procedures a researcher can employ to increase reliability and validity in qualitative research. Reliability is concerned with ensuring the approach to research is consistent, while validity checks for the accuracy of the findings (Creswell, 2009).

3.3.1. Reliability

Robson argued thoroughness and honesty in conducting and reporting research are not enough to increase its reliability[30], a researcher also needs to demonstrate the steps pursued to achieve a thorough and honest investigation (2011). Robson suggested creating an "audit trail" (Robson, 2011, p. 159) of raw data and analysis procedures can increase reliability and allow transparent sharing of the research and its findings. An audit trail can be used to ensure codes and their interpretations remain consistent throughout the research process which Creswell lists as a procedure for increasing reliability (2009).

This researcher undertook every effort to create an audit trail of the three main methods she used. For example, in the review of universities, the researcher created a folder for each university which contained pdf's of its overview page, curriculum and course descriptions. In each pdf document the keywords relevant to this research were highlighted along with their context to make it easy to find them quickly in the future if need be. The faculty member questionnaire contained both numerical and non-numerical data, all non-numerical answers were downloaded and saved in a separate file which was then printed and color coded to identify clusters and create themes. A similar method was used for interview transcripts while the original recordings were also saved and stored in a separate folder in compliance with Virginia Tech's IRB protocol (see appendix 8.6).

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[30] Ensuring the approach to research is consistent.

3.3.2. Validity

Central to validity[31] is the researcher's ability to demonstrate accuracy and correctness through employing a number of strategies which include: triangulation and member checking. Triangulation is a widely used strategy that involves using "different data sources of information" (Creswell, 2009, p. 191) to increase the rigor of research (Robson, 2011). Robson described three types of triangulation:

- Data triangulation is the use of more than one method of data collection such as questionnaires, interviews, observations and survey of documents. This approach to triangulation was adopted in this research through reviewing existing online documents, using questionnaires aimed at ID faculty, and conducting interviews with a sample of the faculty.
- Observer triangulation is enlisting more than one researcher in the study of a situation or an environment. In his *Investigation of Effective Methods for Teaching Social Sustainability with Product Design in British and Irish Universities*, Watkins interpreted observation triangulation to also include member checking (2013) which involves returning transcripts of interviews to those interviewed to check for its accuracy. Member checking also guards against the researcher coloring data and its interpretation based on past experiences and personal characteristics creating research bias and threatening the validity of the research (Robson, 2011).
- Methodological triangulation is the use of both qualitative and quantitative approaches to the research project. Although this research is predominantly qualitative, the use of a questionnaire allowed for the collection of numerical quantitative data along with qualitative data through both open-ended questions within the questionnaire and interviews.

3.3.3. Generalizability

As it is rarely feasible to study an entire population, researchers often aim to generalize findings from studying a sample of the population to the overall population (Robson, 2011). Although this research is mainly qualitative, the generalizability of findings particularly from questionnaires is an important aim of this research to ensure any recommendations derived from the study can be applied to ID programs across the country.

Two main approaches can be used to establish generalizability: "direct demonstration and making a case" (Robson, 2011, p. 92). Direct demonstration involves repeating the study with a different sample or setting and producing findings that match the original study. On the other hand, making a case refers to persuading readers that it is possible to generalize findings from a particular study to the overall

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[31] Relates to the accuracy of the findings.

population by demonstrating the sample shares essential characteristics with the overall population (Robson, 2011). Due to time and resource restrictions, direct demonstration is not a feasible approach to generalizability within a doctoral research project; therefore, this research attempted to make a case for the generalizability of its findings from the sample studied. This alternative was also used by Watkins in his research to infer his findings from surveying a number industrial design faculty to faculty across UK and Irish universities (2013).

To establish generalizability, the sample must be representative of the overall ID faculty population. Although no record was found of the number of ID faculty within the U.S., the Interior Design Education Council members had approximately 530 members listed in its directory at the time of the study who were associated with U.S. institutions. 41% of IDEC members responded to the questionnaire which is arguably a large response rate. Respondents represented universities from all five geographical regions to relatively equal amounts, except for the southwest region which received lower representation (Figure 7 section 3.2.2.5). The number of institutions that offer ID was also not clearly published in one location, however, in consulting two websites that specialize in helping students locate institutions that offer their program of interest (myplan.com and colleges.startclass.com), it was found that the number of institutes that offer ID ranges between 243 – 247 (Appendix 8.2). 108 institutions were represented in the questionnaire responses resulting in an approximate 44% representation rate. Faculty members from both CIDA accredited and non-accredited programs were also represented in the results. The majority of respondents[32] (67%) identified as professors, including full, associate, or assistant, however, adjunct professors were also represented (12%) along with chairs/deans/directors/heads of program (26%)[33]. These percentages demonstrate that the sample, those who had volunteered to respond to this questionnaire, covered the breadth of the U.S. geographically and comprised a large percentage of the population which supports the generalizability of findings to the overall population.

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[32] Some faculty held more than one position therefore the 203 participants generated 244 responses to the question that asked them to indicate their current academic position in the questionnaire.

[33] 2% indicated they were TAs and 3% respondents choose "other" and explained by writing emirates or instructor or lecture. These "other" responses were not adjusted because the researcher did not want to make assumptions about the position. Within the "other" category there were also an *assistant director and coordinator* and two comments: *program coordinator*, these three responses were not counted as "other" but rather they were added to the "chair/dean/director/head" count.

4. Results: Questionnaire and ID Programs' Review

4.1. Overall Organization of Results

The four research questions were examined through the use of three research methods: a nationwide questionnaire, review of ID programs and interviews with ID faculty members. Findings were presented in two chapters and were organized to respond to each research question separately. Chapter 4 presents findings from the questionnaire and review of ID programs as they both provide broad responses to the research questions. Interview results on the other hand, were discussed separately in chapter 5 as they 1) built on findings from the questionnaire and review and 2) provided an in-depth response to the research questions.

This organization of findings allows the reader to smoothly follow the finding's logic as it moves from broad to profound. It also aids in understanding how the different blocks of research result came together and formed a holistic amalgamation narrated in the summary chapter (0).

4.2. Organization of Chapter 4

In this chapter findings have been organized to correspond directly with this research's four questions (section 1.3). The chapter begins by identifying the current state of DfSB within ID programs in order to establish a baseline from which to build recommendations. DfSB's current state was investigated in relation to two key players: faculty and ID programs. As it would arguably be harder to integrate DfSB into ID if the faculty themselves do not support the topic and its essence, their acceptance of DfSB, its tenets and attitudes towards teaching it were gauged. Understanding the status of DfSB within programs was important for identifying gaps and opportunities for improvement. To understand DfSB's current state within ID programs two resources were used, the first was a review of ID programs' online material in search of DfSB or similar terms/concepts. The second resource was the questionnaire which asked faculty if they teach DfSB, what they teach and how they teach it.

The chapter then moved into identifying potential barriers to integrating DfSB into ID programs. The barriers explored fell under four main categories: 1) faculty knowledge, awareness and perceived benefits of DfSB, 2) DfSB's complexity, process and ethical implications, 3) stakeholders'[34] interest in DfSB, and

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[34] Stakeholders included: students, industry, clients and professional and academic accreditation and certification bodies.

the 4) availability of resources. This section then ends with respondents' suggestions for overcoming one of the more prevalent barriers to DfSB integration.

The third part of this section dealt with faculty suggestions on the DfSB content to be included in ID along with appropriate teaching methods. Lastly, The chapter concluded by exploring faculty members' reactions to the fourth and final research question concerning the ethics of using design to intentionally change behavior

4.3. Identifying Current State of DfSB in US ID programs

To address the first research question, namely; *what is the current state of DfSB in U.S. ID programs;* the researcher examined the presence of DfSB within two pillars of an educational institute; faculty and program.

4.3.1. Current State: Amongst Faculty

DfSB understanding amongst faculty was explored through three main questions: how familiar are faculty members with DfSB, how acceptant are they of its basic tenets and finally what are their attitudes towards teaching it?

4.3.1.1. Faculty familiarity with DfSB

Before the questionnaire provided a definition of DfSB for faculty to base their answers on, they were asked to indicate their familiarity level with the field by rating their knowledge on a five point scale (not at all familiar, slightly aware, moderately aware, fairly familiar, and very knowledgeable). Their selections are referred to throughout this document as *faculty's self-identified familiarity with DfSB*. All respondents, except those that identified they were not at all familiar with DfSB, were then asked to define or describe it in their own words. Those who indicated they teach it themselves were asked to list resources they use. Through analyzing the definitions and resources provided, faculty familiarity was reassessed.

4.3.1.1.1. Self-identified familiarity

Of all the respondents, 27% identified themselves as either *not at all* or *slightly aware* of DfSB, while the remaining 73% believed they were either *moderately familiar*, *fairly familiar,* or *very knowledgeable* (Figure 9). The smallest percentages were of those who identified as *not at all familiar* and those who believed they were *very knowledgeable*.
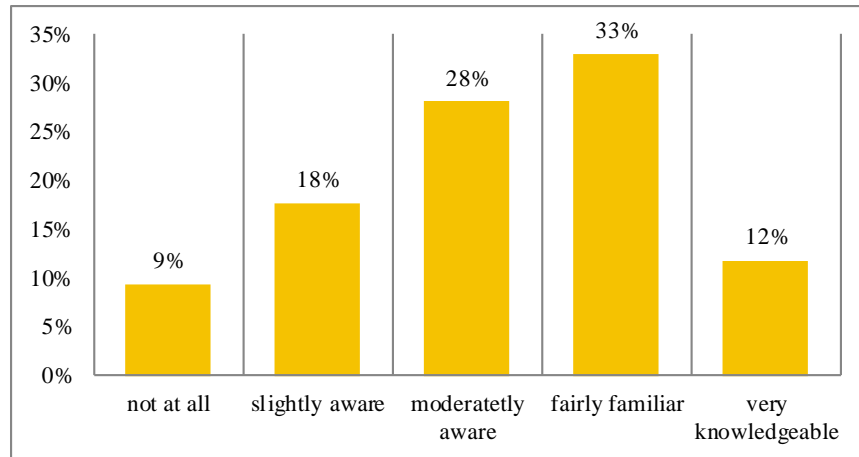
Figure 9 - Faculty self-identified familiarity with DfSB

4.3.1.1.2. Familiarity with definition

To ensure faculty were assessing their familiarity accurately, all respondents, except those who indicated they were *not at all* familiar with DfSB, were asked to define or describe DfSB using their own words. Of the 184 who met this criterion, 152 (82%) provided definitions. The criterion used to evaluate the accuracy of the definition provided by participants was to compare it with DfSB's definition as put forth by its scholars. DfSB scholars define it as: "an emerging activity under the banner of sustainable design which aims to reduce the environmental and social impacts of products by moderating users' interaction with them" (Lilley & Lofthouse, 2010b, p. 55). This definition was broken down into four main elements and the responses evaluated based on the degree to which they included these elements (Table 5):

1. DfSB is part of sustainable design
2. Its aim is to reduce social and environmental impact
3. of products
4. Through modifying / influencing / changing behavior

The third criterion relating to products expected faculty to provide some context to the field indicating its origins in industrial design, or that it is mainly applied through products thus far.

DfSB Familiarity	Criterion
Very Knowledgeable	If all (5) criteria were mentioned And if the definition provided accurate context mentioning the field originated in industrial design
Fairly Familiar	If (4) of the criteria were mentioned
Moderately Aware	If (3) of the criteria were mentioned
Slightly Aware	If (2) of the criteria were mentioned
Not at All	If none of the criterions were mentioned Or if changing behavior and/or sustainability was not mentioned

Table 5- criterion for judging definitions

Using this criterion to evaluate faculty definitions, it was found that many faculty assumed they were more familiar with DfSB than they were able to demonstrate through their definitions. The largest percentage (40%) did not include any of DfSB's components in their definitions which illustrated they were not familiar with the scholarly definition, the 3% who mentioned 1 of the 4 elements demonstrated a slight awareness of the field. The second largest percentage was of those who mentioned 2 of the 4 elements which indicated a moderate awareness of DfSB (39%). Mostly these definitions indicated the use of design to influence sustainable behavior but did not mention what type of behavior (environmental or social) nor did they refer to the use of products. A small percentage (16%) demonstrated they were fairly familiar by naming 3 of the 4 elements and only 1% of the respondents provided an accurate definition of DfSB.
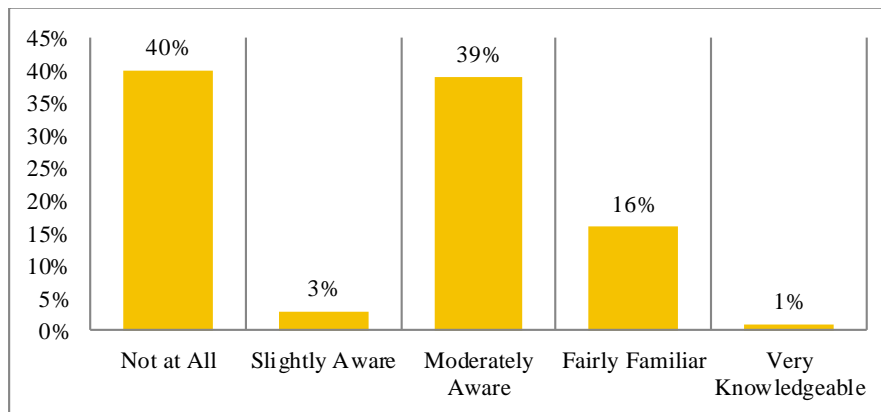
Figure 10- Faculty familiarity with DfSB based on an evaluation of the definitions they provided

Some of the definitions seemed closer to a rewording of the title: Design for Sustainable Behavior, similar to the examples below, which made it difficult to determine whether these answers were based on guesses or an actual familiarity. Nonetheless, definitions were categorized based on the criteria above regardless of whether or not they appeared to be speculations. The following three statements are examples of definitions that may have been speculative:

Using design to encourage sustainability by users and designers.

using design to engage occupants in behaviors that enhance sustainability

The way that a space is designed can encourage or deter sustainable behavior.

The elements of the definition mentioned the most were the first and fourth, namely; that DfSB aims to achieve sustainable designs through the manipulation of behavior.

4.3.1.1.3. Familiarity with resources

Another question, intending to deduce just how familiar faculty are with DfSB, asked them to list resources they use to teach DfSB. Of the 203 faculty members who answered the questionnaire, 67% (138) indicated DfSB is either explicitly or implicitly offered in their program, and 61% (85) of which indicated they **teach it** themselves. These 85 respondents were asked to list *specific* resources they use to teach DfSB to determine 1) faculty familiarity with DfSB through their knowledge of its foundational literature, and 2) the shared DfSB body of knowledge among faculty. The researcher intentionally used the word *specific* so that faculty would only list resources that pertain directly to DfSB. 80% (68)[35] of respondents provided comments, some of which included more than one resource in the same comment resulting in a total of 86 resources. Some resources were placed in one category, namely; case studies, guest lectures, professional examples, articles, websites, books, professional and academic work experience and site visits. These were categorized as non-specific as they can be used to teach any subject and do not help the researcher determine foundational literature shared by faculty members. Five other categories emerged from the analysis and are listed, along with their percentages, are listed in Table 6.

Resource Category	#	%
Non-specific	42	48%
Sustainable Design	15	17%
LEED and USGBC	15	17%
Related Topics	10	12%
Behavioral Fields	3	6%
DfSB literature	1	1%
Total	**86**	

Table 6- Six themes that emerged from faculty response to resources they use to teach DfSB

The highest percentages (48%) of resources listed were categorized as *non-specific* because respondents did not provide any specificity that demonstrates how these sources relate directly to DfSB and not any other topic. Faculty members could have named authors of books, projects, or article titles to link these non-specific resources to DfSB. The second highest percentage (17%) was for LEED and USGBC guidelines along with topics relating to sustainable design (17%). It would have been more promising

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[35] The total number of responses to this question was 73 however 5 comments were excluded from the analysis as they stated comments like: the question is too vague, there are too many resources, don't use formal resources, none, student or other faculty.

however had faculty cited specific credits that pertain to DfSB within LEED such as the Occupant Engagement Credit. Despite this credit's limited scope of changing behavior through the use of design, referencing it would have indicated an actual familiarity with DfSB as opposed to assuming LEED included it.

Faculty also listed topics that are not part of DfSB literature but could potentially relate to the field including: cradle to cradle, evidence-based design, biomimicry and wellbeing. As DfSB is an interdisciplinary area that pulls knowledge from multiple resources, it is possible for the topics listed to be applicable within DfSB.

To a lesser extent, respondents also referenced behavioral fields such as environmental psychology and human factors (6%) as resources they use to teach DfSB. Of the 68 faculty members who answered this question, only 1 person listed the work of key DfSB scholars, namely; the work of Wever and Boks.

One faculty member did mention "it is hard to find resources in this area," which is a valid claim as DfSB is a new research area particularly focused on product-based solutions thus far. Its novelty however, has resulted in publications from a tight-knit group of scholars. Additionally, numerous reports prepared for the building industry (see 2.1.2) although they do not reference DfSB directly; discuss building, behavior and sustainability. The majority of respondents did not mention anything that related to these resources.

It appears faculty believed they were more familiar with DfSB then they were able to articulate in the definitions they provided and resources cited. This suggests a unified and accurate understanding of DfSB, and what it encompasses, is lacking within the ID community.

4.3.1.2. Agreement with DfSB tenets

The second question intended to gauge faculty's understanding of DfSB was their agreement with its basic tenets. This was important to establish because if faculty members agreed with the tenets they would arguably be more likely to accept DfSB's integration into their curricula than if they fundamentally disagreed with what it stood for. The researcher opted to ask faculty about their agreement with DfSB tenets instead of asking directly about DfSB to avoid inaccurate answers due to respondents not sharing a unified understanding of the field. This proved to be a good choice considering findings from section 4.3.1.1.2 indicated faculty do not share a common definition of DfSB. To accomplish this, DfSB was broken into four main tenets or beliefs that particularly pertain to ID:

1. It is part of interior designers' responsibilities to create sustainable interiors to decrease buildings' negative impact on the environment,

2. Occupant behavior affects buildings' sustainable performance,

3. Design can encourage certain behaviors over others,

4. Interior designers should encourage sustainable behaviors through design.

It was assumed that if faculty agreed with DfSB's sum (i.e. its tenets) that would indicate an agreement of DfSB as a whole. Several questions were used to determine agreement of each tenet as illustrated in Table 7. In the questionnaire, participants were asked to indicate the degree to which they agree with each statement.

	Tenet	Statements in Questionnaire
1	It is part of interior designers' responsibilities to create sustainable interiors to decrease buildings' negative impact on the environment	Designing sustainable interiors reduces the building industry's negative impacts on the environment
		The benefits of sustainable design on the environment have been over emphasized.
		It is an interior designer's professional responsibility to create sustainable interiors.
2	Occupant behavior affects buildings' sustainable performance	Occupant behaviors impact sustainability in buildings
		It is important to reduce any adverse impact of behavior on the environment when possible.
		It is the occupant's responsibility, not the designer, to consider the impacts of their behaviors on the environment.
3	Design can encourage certain behaviors over others	Design, by its very nature, encourages certain behaviors over others to achieve the designer's intent
		Trying to influence behavior is beyond the scope of interior design
		Occupant behavior is too varied and unpredictable for it to be included in design decisions
4	Interior designers can and should encourage sustainable behaviors through design	Encouraging occupants to engage in more sustainable behaviors (like using less energy and recycling regularly) can significantly reduce the negative impact of buildings on the environment
		Most interior design projects already encourage sustainable behavior through their designs
		It is interior designers' professional responsibility to encourage sustainable behaviors through their designs

Table 7- Questions used to determine to respondents'' attitudes towards DfSB tenets.

Respondents reacted positively towards designing sustainable interiors (Figure 11), DfSB's first tenet, and believed it was part of interior designers' responsibility (93%). They also agreed that the benefits of such designs have not been overemphasized and can reduce the building industry's impact on the environment.

The second tenet pertained to the impact behavior has on sustainability to which faculty also reacted positively (Figure 11) indicating they believed the decisions people make affect building performance (90%). This could indicate faculty members are either aware of the literature arguing buildings cannot achieve desired levels of sustainability unless occupant behavior is considered (2.1.2) or share the same opinion. Respondents also reported they believed adverse effects of unsustainable behavior should be reduced (95%) and 53% of faculty found this to be occupants' responsibility, not designers. This opinion

was not unanimous as 29% neither agreed nor disagreed and the remaining 18% did not think reducing the impact of behavior fell to the occupants. This may indicate that faculty members feel designers share such responsibility with occupants as discussed in the fourth tenet bellow.
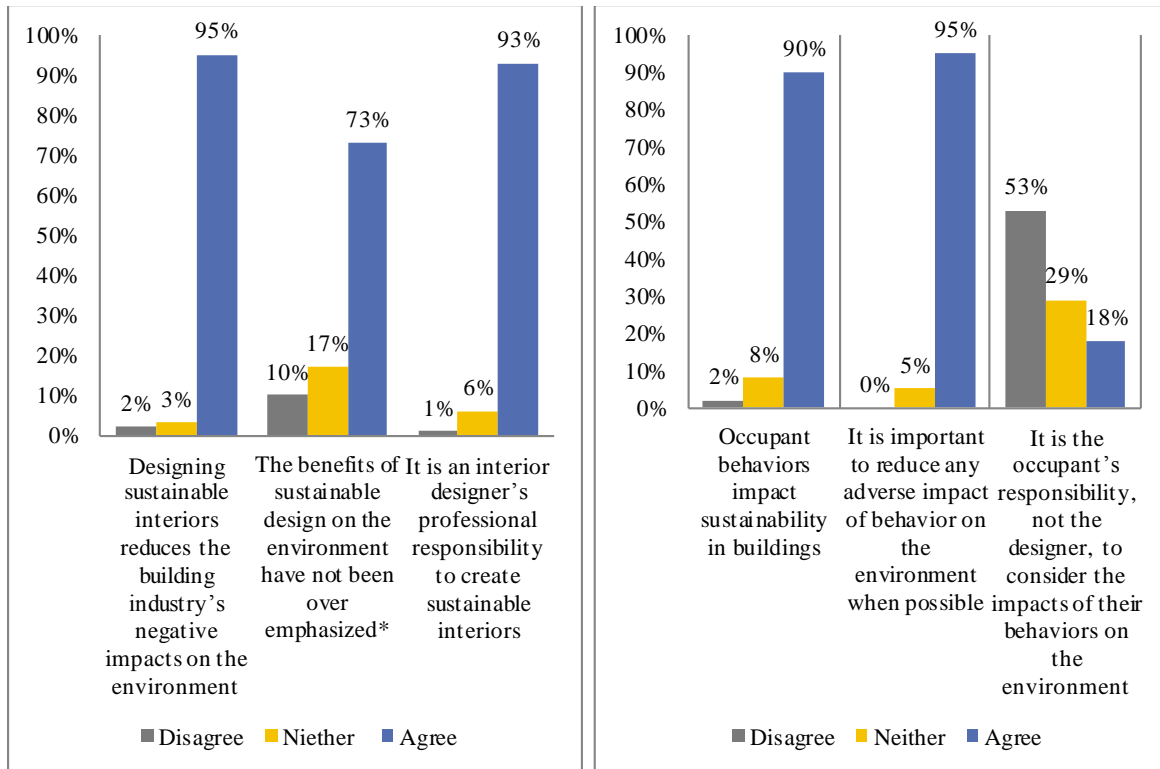

Figure 11 - Faculty response to DfSB's first and second tenet (*) Indicates the question was originally in the negative but adjusted here in the graph.

Respondents also appeared to be positive towards the third tenet (Figure 12) indicating design can encourage certain behaviors over others (86%) and did not perceive this to be beyond designers' scope of work (91%). They also did not believe that the inherent complex and varied nature of human behavior prevents designers from considering it in their design decisions (88%).

The fourth tenet (Figure 12) lies at the heart of DfSB, namely; using design to intentionally encourage sustainable behaviors. Similar to their beliefs regarding the previous three tenets, respondents agreed with this tenet, indicating that they believed using design to encourage sustainable behavior can significantly reduce the impact of buildings on the environment (93%) and viewed this as part of a designer's responsibility (90%). Slightly more than half the sample (54%) believed interior design projects do not currently encourage sustainable behaviors through design, which may be due to a number of reasons, one

of which might be that educational institutions, although hold positive beliefs towards DfSB's tenets, are not doing enough to assimilate DfSB into ID industry.
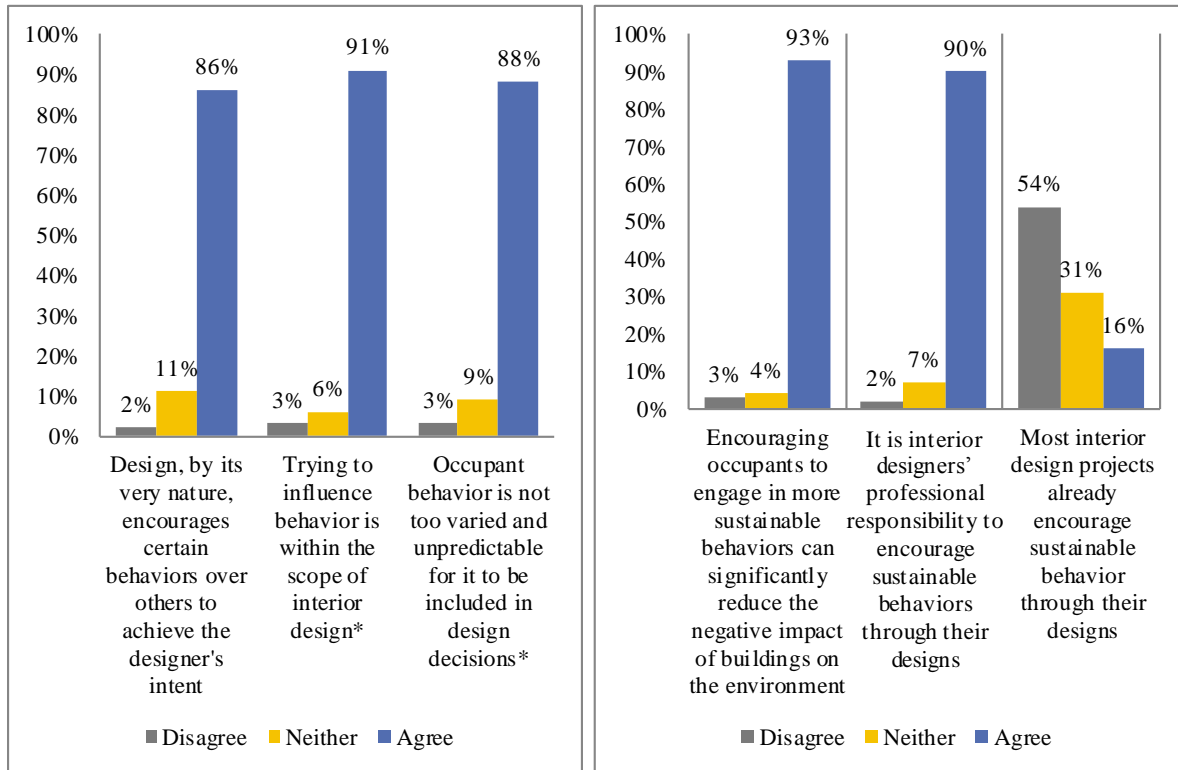

Figure 12 - Faculty response to DfSB's third and fourth tenet. (*) Indicates the question was originally in the negative but adjusted here in the graph.

These positive attitudes indicate an awareness of, and agreement with, the essence of DfSB, despite faculty members' limited familiarity with the field as results from section 4.3.1.1 indicated.

4.3.1.3. Attitudes towards teaching DfSB

The final question pertained to ID faculty attitudes toward DfSB. Attitudes were favorable towards teaching DfSB in ID (Figure 13) with the majority (94%) indicating they believed DfSB is an important topic for ID, are interested in teaching it (81%) and even feel obligated to do so (74%). When asked whether or not they think other faculty members believe DfSB is important, 61% of the respondents agreed they did, while 32% neither agreed nor disagreed. These responses illustrate that both personal and social norms within the ID academic community are thought to be supportive of including DfSB. Here

again, results indicate a high level of commitment to the issue of design and sustainable behavior despite a limited accurate familiarity with it.
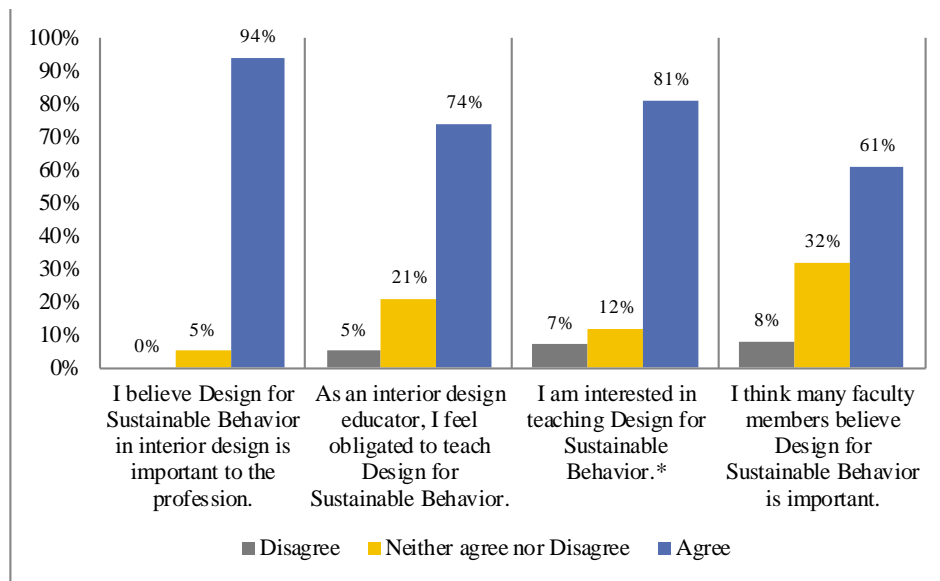

Figure 13- faculty beliefs and attitudes towards teaching DfSB. (*) Indicates the question was originally in the negative but adjusted here in the graph.

Although faculty may not have rigorous and academic understanding of DfSB, it is clear that they are positive towards its basic tenets, believe it should be practiced in ID and advocate teaching it. They may also include aspects of it within their teaching already which will be explored in the following section (4.3.2).

4.3.2. Current state: within ID Programs

With faculty displaying positive reactions towards DfSB, the researcher next examined the extent to which DfSB is currently present within ID programs. This was accomplished through first: reviewing online material from ID programs and second: including specific questions within the nationwide questionnaire. Findings from these two phases are discussed below.

4.3.2.1. Review of ID program: inclusion of DfSB in ID

A review of top ID programs was conducted to identify the presence of DfSB's basic tenets in their online material including: program overviews, curricula, and course descriptions. If courses that include parts of DfSB are identified within existing programs, they can be capitalized on and a vision for DfSB can grow

from within and beyond these courses. A word search was carried out within this online material to locate and study the following words and phrases: 1) sustainability, 2) behavior, and 3) encouraging/influencing sustainable behavior through design.

The literature published online varied by program; however, program overviews, curricula and course description were found for 12 programs rated highest by Design Intelligence 2015. An online randomizer (www.randomizer.org) was used to rearrange the order of the programs so they can be listed anonymously with an analysis of their content in (Table 8).

Sustainable design was well represented within the sample as 8 schools mentioned it in at least 2 of the 3 sources examined. Various sustainable design topics were offered through both lecture and studio courses, however only a small number of programs had dedicated courses to sustainability. This may be due to programs intentionally integrating sustainable issues into various courses as opposed to dedicating separate courses to it, which matches findings from Crane's (2008) study of sustainable design education in ID (see 2.2.1). Sustainable design was offered within the contexts of ecology, building systems, building methods, materials, and adaptive reuse among other topics.

Behavior was less present compared to sustainability, however; its presence was by no means lacking as 6 schools mentioned behavior in at least 2 of the 3 sources examined. The main difference between sustainability and behavior was that 9 of the 12 programs included sustainability in their *overviews*, while behavior was only mentioned in 3. Behavior was offered in courses through the lens of behavioral science and human factors courses. Some of the common topics discussed within human factors and behavior included: perception and cognition, cultural differences in space use, proxemics, anthropometrics, and ergonomics.

Degree	CIDA	Sus. in program overview	Sus. in courses	Sus. in studio		Beh. in program overview	Beh. in courses	Beh. in studio		Encouraging sus. Through design
BS	YES	Y	Y	Y	**YYY**	Y	Y	Y	**YYY**	N
BFA	NO	Y	Y	Y	**YYY**	N	Y	Y	**NYY**	N[36]
BS	NO	N	Y	N	**NYN**	N	N	Y	**NNY**	N
BFA	NO	Y	Y	Y	**YYY**	N	Y	N	**NYN**	N
BFA	YES	Y	Y	Y	**YYY**	N	Y	Y	**NYY**	N
BS	YES	N	Y	N	**NYN**	N	N	Y	**NNY**	N

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[36] Does not make a clear link to sustainability per-say but asks all the right questions: "*How does the built environment shape our contexts and, by extension, our understanding? What potential lies in an interior's design? How does a product instruct a user? When does a building determine action?*"

BFA	YES	Y	N	Y	**YNY**	N	Y	Y	**NYY**	N
BS	YES	N	Y	N	**NYN**	N	Y	N	**NYN**	N
BFA	YES	Y	Y	Y	**YYY**	N	N	N	**NNN**	N
BFA	YES	Y	Y	Y	**YYY**	N	Y	N	**YYN**	N
BS	YES	Y	Y	Y	**YYY**	Y	Y	Y	**YYY**	Y[37]
BFA	YES	Y	Y	Y	**YYY**	N	Y	N	**NYN**	N

Table 8 - Review of undergraduate ID programs

Although both sustainability and behavior issues are covered in these programs, encouraging sustainability through the use of design was not explicitly mentioned in any. Nonetheless, 3 programs discussed the influence of design and the environment on behavior in either general terms as in program 7 and 12, or in relation to health and wellbeing.

This review of select ID programs revealed a number of important findings. First, DfSB was not mentioned in any of the courses, nor was the notion of actively changing or influencing behavior. Second, sustainable design is offered through and within different courses as are behavior topics; for the most part however, the two do not seem to be linked or discussed simultaneously. Lastly, a few programs include courses that ask explicit questions pertaining to the effects the built environment has on behavior, however, an advocacy component seems to be lacking as these course descriptions only mention understanding and examining as opposed to applying or using this knowledge. It is possible that these courses do in fact advocate actively using the environment to change behavior and that this was not clearly stated due to the nature of course description and the need to keep them short and concise, this assumption was tested further in the interview phase of the study (section 5.1). Nonetheless, excluding the mention of using the environment to influence behavior from the course description suggests it is not the main focus or a primary goal of the course.

Next, through the nationwide questionnaire, respondents were asked about the presence of DfSB in their programs, the content they cover and methods they use to teach it. This was to identify the state of DfSB from which to build this research's recommendations.

4.3.2.2. Faculty Questionnaire: inclusion of DfSB in ID

In support of the review of the online material institutions published on their programs, more detailed information was solicited from faculty members across U.S. programs through the questionnaire. After

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[37] Does not exclusively mention of environmental sustainability but there is a definite focus on social sustainability in the sense of health and creating spaces to change behavior.

the first part of the questionnaire (discussed in section 4.3) respondents were provided with a definition of DfSB along with examples (Figure 14). This was to ensure they had a unified and accurate reference to use while responding to the following questions 1) does your ID curriculum cover DfSB, 2) are you personally involved in teaching it, 3) what DfSB content currently exists in ID, and 4) what are the methods used to teach DfSB.

What is Design for Sustainable Behavior?

In this survey, **Design for Sustainable Behavior** is defined as a sub-category of sustainable design. It uses design *strategies* to encourage sustainable behaviors like conserving energy and recycling.

These design *strategies* (figure below) fall into three main categories (informing, persuading, determining), each containing subcategories of their own. The strategies are organized on a continuum with designs that allow the occupants to be in control of their behavior on one end and designs that control occupants' behavior on the other (click here for more examples).

Based on an understanding of occupants and reasons driving their behaviors, designers can select appropriate strategies to encourage sustainable behavior.
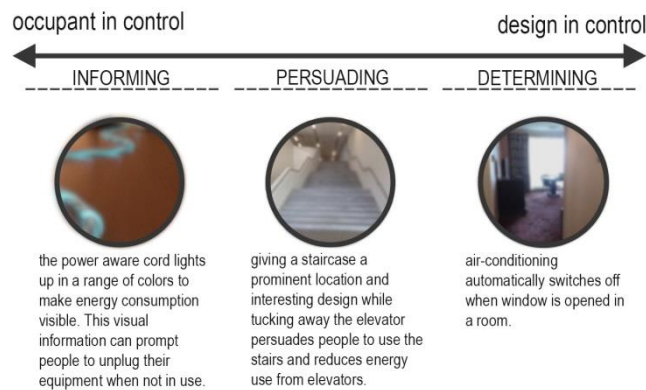

Figure 14- DfSB definition provided in the questionnaire

4.3.2.2.1. Inclusion of DfSB in ID programs

To identify the inclusion of DfSB within ID, faculty members were asked to indicate whether their respective programs offered it and whether they taught it themselves. Of the 203 questionnaire respondents, the majority (67%) indicated their program offered DfSB either explicitly or implicitly, 20% did not believe it was offered and 12% did not know what the state of DfSB is in their programs (Figure 15).
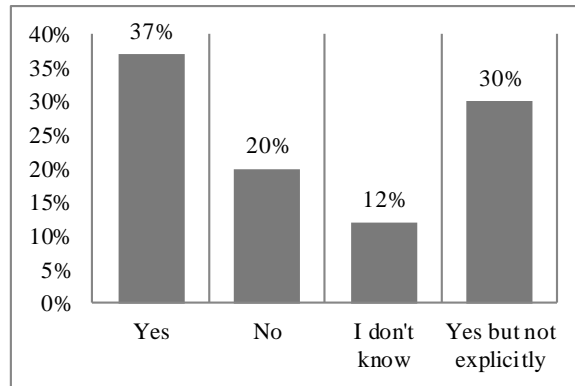
Figure 15 - Percentage of programs that offer DfSB as part of their curriculum

Of the 108[38] institutions that were represented 38% (41) had more than one faculty respond to the questionnaire and were therefore analyzed separately. It was found that of these 41 institutions, 76% (31) had inconsistent responses in regards to DfSB's inclusion in their program (Table 9). In some instances, there were drastic contrasts as one faculty answered *no* and another *yes* to the inclusion of DfSB within the same institution. Other differences were subtle with combinations of *yes/no and I don't know* or *yes/no and not explicitly.*

Total number of institutions	Institutions with more than one faculty answer questionnaire	DfSB explicitly taught in programs	
		Inconsistency found among faculty	consistency found among faculty
108	41	31	10

Table 9 - Number of institutions that had more than one faculty respond to the questionnaire

To eliminate any doubt that a faculty member's academic position may affect their full exposure to the curriculum and its content[39], respondents' academic position was examined. The academic position of the 78[40] respondents belonging to schools with inconsistent answers did not seem to affect the responses as 89% of faculty members within the programs with inconsistent answers were a mixture of professors[41] (69%) and department or program leaders (20%). Only 10% of respondents were adjuncts or TAs. It can be argued that adjuncts may have a limited level of exposure to the curriculum in some cases, however as they did not represent a large sample, it is unlikely the inconsistency was only due to adjunct responses. Additionally, respondents' self-identified level of familiarity with DfSB did not affect their answers as

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[38] More institutions were actually represented; however, not all respondents indicated which institution they belong to. As such this number only reflects the number of institution names shared by faculty members.

[39] A full time faculty without an administrative position may not be as involved in curriculum development as the program leader or chair, similarly some may argue an adjunct professor is not as exposed to the full curriculum like a full time faculty is

[40] A total of 84 responses were recorded because 6 faculty members held two academic positions.

[41] This included: full, associate, assistant

there was no clear pattern, in fact in some cases, faculty within the same school and the same self-identified level familiarity with DfSB, gave two different answers.

This inconsistency in response despite equal access to curriculum and self-identified level of familiarity with DfSB suggested DfSB is not a prevalent topic faculty members would discuss when planning curricula development or course content, otherwise, its presence in a program would have been known to those who share the same institute and level of familiarity. This also supports an earlier finding indicating a unified and accurate understanding of DfSB and what it encompasses is lacking within ID (4.3.1.1).

On the other hand, respondents from 10 institutions gave internally consistent answers regarding the presence of DfSB three of which had more than one faculty member indicate that DfSB is *explicitly* offered in their program. However, a review of these three programs online material (similar to the one conducted in 4.3.2.1) did not reveal such. A keyword search was conducted on the programs' indicating they teach DfSB explicitly overviews, curricula and course description to identify the presence of the following words or phrases:

1. DfSB
2. Sustainable behavior
3. Behavior
4. Sustainability
5. Changing / Encouraging / Influencing

Neither DfSB nor sustainable behavior as terms were found, however; there were courses dedicated to behavior within the context of consumer behavior, environmental psychology or research but not in relation to sustainable behavior. Similarly, sustainability was offered in a number of courses, however, there was no indication that design was taught as an agent of influencing or encouraging sustainable behaviors. It is possible DfSB is taught in these programs and not included in online publications as there are many topics covered within ID education and not all of which are published online. Follow-up interviews with faculty members elicited their opinions on why DfSB is not clearly articulated in ID online material (section 5.1).

On the other hand, programs whose faculty believed they implicitly include DfSB, arguably provided a more accurate representation of DfSB within ID. Respondents who indicated DfSB is *implicitly* offered were asked to explain their selection in a comment space. In reviewing and coding their responses four main themes appeared (see comments in Appendix 8.6):

1. DfSB as a term is not used in ID.

2. Some aspects of DfSB are taught but not in relation to sustainable behavior.
3. DfSB is offered as part of other courses.
4. DfSB education is inconsistent and in some cases underemphasized depending on the faculty member.

These four themes support findings from reviewing top ID programs (4.3.2.1) and from reviewing the 3 programs above whose faculty unanimously indicated they offer DfSB explicitly.

4.3.2.2.2. Inclusion of DfSB content: theoretical fields and components

Although little proof was found to support DfSB's explicit presence in ID, it was apparent aspects of it exist in an implicit form. To draw a clearer understanding of this, the questionnaire asked a series of questions to identify DfSB content within ID programs. First, **all respondents** were asked to indicate whether they discussed any of DfSB's theoretical fields (2.3.1) in sustainable design courses. Second, faculty members who believed they **teach** DfSB were asked to select all of the DfSB components they cover in their courses from a list. This is explained further below.

From reviewing the literature (2.3.1), five theoretical fields were found to be major contributors to DfSB and its components, namely; social psychology, consumer behavior, user-centered design, persuasive design, environmental psychology and sustainable building science. Fields were not named in the questionnaire, rather a brief explanation was provided to highlight what is relevant in the field to DfSB and limit misinterpretations. The fields were described in the questionnaire as follows (Table 10):

	Theoretical field	Definition used in questionnaire
1	Social psychology[42]	*Understanding people's attitudes, beliefs and reasons behind behaviors.*
2	Consumer Behavior[43]	*How and why people buy and dispose of products related to interiors.*
3	User-centered Design[44]	*Involving stakeholders (owners and occupants) in the design process.*
4	Persuasive Design[45]	*Changing attitudes and behaviors using products and strategies.*
5	Environmental Psychology[46]	*How people affect, and are affected by their environment.*
6	sustainable building sciences	*Measuring outcomes of designs for changing behavior.*

Table 10- DfSB theoretical field as presented to faculty in questionnaire

All respondents were asked to determine the degree to which they discuss these theoretical fields within sustainable courses. As illustrated in Figure 16, the area 53% of faculty believed they *always* covered was

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[42] (Daae, 2014; Pettersen & Boks, 2009; Tang, 2010)
[43] (Pettersen & Boks, 2009; Spencer, 2014; Tang, 2010)
[44] (Daae, 2014; Pettersen & Boks, 2009; Tang, 2010)
[45] (Lilley, 2007; Lockton, 2013; Pettersen & Boks, 2009)
[46] (Lockton, 2013)

environmental psychology followed by sustainable building science (37%). User-centered design was *often* included (42%) followed by consumer behavior and persuasive technology, while for the most part, social psychology was only covered *sometimes*. This indicates ID faculty members are familiar with the theoretical fields essential to DfSB and cover most of them when discussing sustainable design. These findings also suggest social psychology, a major component of DfSB, is not currently covered adequately enough.
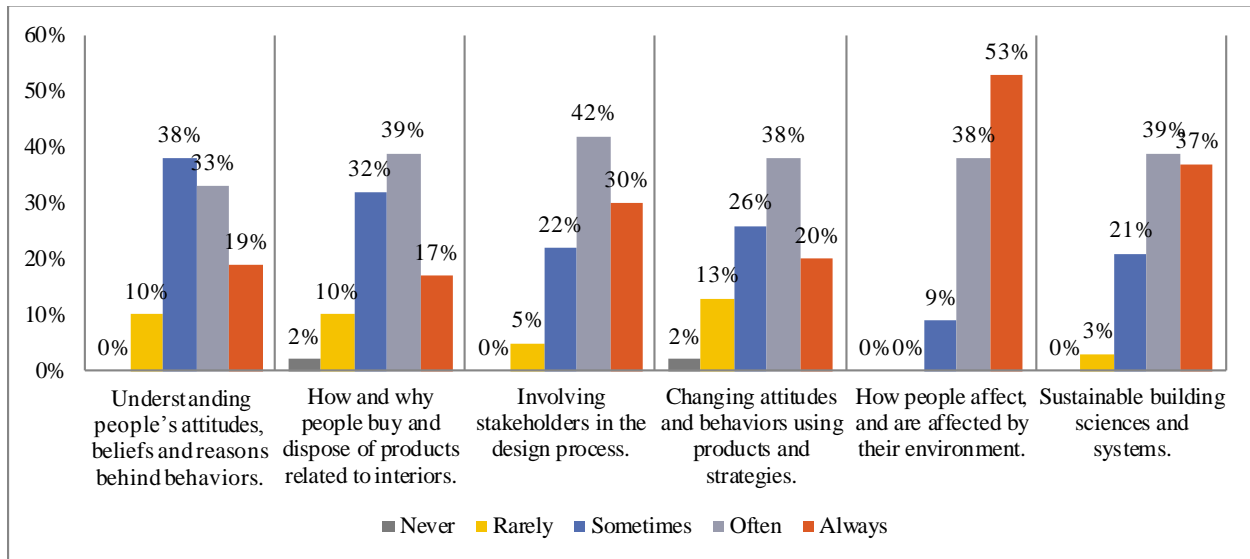

Figure 16- Theoretical fields currently addressed in sustainable interior design education

It is not clear however whether or not these theories are discussed within the context of sustainability. This concern was spurred due to the following faculty comments:

"We cover design strategies to modify behavior in Human Factors courses but not specifically referencing sustainable behavior"

"The two issues (user behavior and sustainability) have not been joint as specifically"

This assumption regarding theories not discussed within the context of sustainability is also supported by respondents' earlier description of DfSB's implicit presence in their programs, particularly, their comment explaining DfSB topics are taught but not necessarily in relation to sustainable behavior 4.3.2.2.1.

The second question exploring content focused on identifying the presence of DfSB components within ID. Each theoretical field contributes to a certain DfSB components as illustrated in Figure 17. Social psychology, consumer behavior and environmental psychology are used to identify *theories and models of behavior change*. Literature in persuasive technology and user-centered design contains numerous

strategies for changing behavior and inspires proposals for new ones. User-centered design forms the basis of DfSB's *design process* from which several scholars built intricate processes (2.3.3). Sustainable building science along with behavioral knowledge from social psychology guide designers as they identify and *measure unsustainable behavior* establishing baselines against which to measure outcomes of a DfSB intervention. Finally, *ethical concerns* can be explored through literature in persuasive technology and employing a user-centered design process that involves users in multiple phases of the design ensuring their concerns are identified and addressed.

Components

Theories	Strategies	Process	Measurement	Ethics

Theoretical Fields

Social psychology	Persuasive technology	User-centered design	Sustainable building science	User-centered design
Consumer behavior	User-centered design		Social psychology	Persuasive technology
Environmental psychology				

Figure 17- theoretical fields and DfSB components

These components were presented in the questionnaire as demonstrated in Table 11. The questionnaire asked **faculty who believe they teach DfSB** to select from the list of components all the ones they offer in their own courses.

	Component	Description used in questionnaire
1	*Theories*	Understanding and applying behavior models and theories of change.
2	*Design strategies*	Surveying existing strategies for changing behavior.
		Proposing new strategies for changing behavior.
3	*Design process*	Designing with stakeholders: user-centered design.
4	*Measuring outcomes*	Measuring outcomes of designs for changing behavior.
5	*Ethics*	The ethics of changing behavior through design interventions.

Table 11- Components as defined for participants in the questionnaire

Of the 85 respondents who indicated they teach DfSB 84 responded to this question. It appeared components are covered in ID education to a promising extent (Figure 18). *Designing with stakeholder* along with *proposing new strategies for changing behavior* were selected by 74% of the 85 respondents and were followed by *the ethics of changing behavior through design* (60%), *understanding and applying behavior models* (51%) and *surveying existing strategies for behavioral change* (48%). *Measuring outcomes of interventions* received the least amount of selection indicating it is not often offered in DfSB education within ID programs.
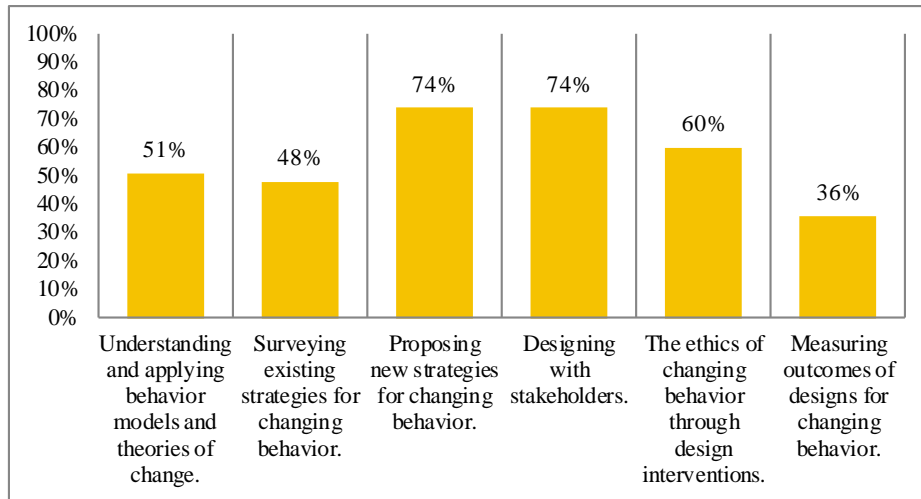
Figure 18- DfSB components incorporated in interior design curriculum

The first component: theories, only received half the selections, which is an intriguing finding as theories of behavior are at the core of DfSB and impact all phases of a design process[47]. This percentage may indicate a large portion of faculty members are not aware of the theories that shape or provide the basis of DfSB. Additionally, social psychology is one of the main theoretical fields/knowledge domains that contributes to DfSB's theories, and as indicated above (Figure 16) its presence in ID was found to be limited. Viewed together the limited presence of social psychology and theories of behavior change are arguably logical findings.

As for the second component relating to design strategies, it was unclear why more respondents indicated they focus on *proposing new strategies* more often than *surveying existing strategies,* even though it may be argued one would start by surveying existing strategies to identify gaps or opportunities for development before proposing new strategies. This might indicate faculty are not aware of existing strategies and believe they should encourage proposing new ones as part of traditional ID education, particularly as it relates to design and creativity.

The third component (i.e. using a user-centered design process) is a fundamental component of DfSB, and it was encouraging to find many ID respondents believe they include it when teaching DfSB. The least emphasized component was measuring outcomes of designs targeting behavior change. One might argue that this component should be emphasized in ID education in order to demonstrate tangible results to clients and peers and consequently increase DfSB adoptability by industry. 60% of respondents indicated

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[47] Theories affect: measuring building performance, identifying unsustainable behaviors, determining factors driving these behaviors, and selecting intervention strategies

they explore the ethics of changing behavior through design when teaching DfSB. Ethics is discussed further in 7.1.3.

In an effort to answer the first research question (What is the current state of DfSB), the final area examined was the methods used to teach DfSB within ID discussed in the following section.

4.3.2.2.3. How DfSB is included: teaching methods

The majority of faculty indicated DfSB is offered as part of a broader studio (51%), broad lecture course (36%) and through integrating it in multiple courses (35%) as shown in Figure 19. The prominence of DfSB within studio courses and as a topic integrated in multiple courses is similar to how Crane (2008) found sustainable design in general is taught within ID programs (2.2.1).
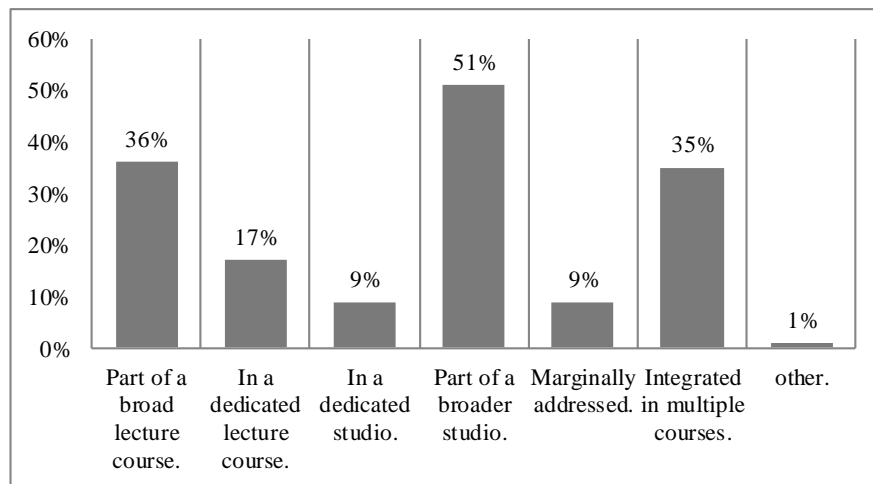

Figure 19 - Courses currently offering DfSB

Faculty members who indicated their program integrated DfSB in multiple courses were asked to expand on their selection in a comment space (see Appendix 8.8 for comments). In addition to reiterating DfSB's integration in studio and lecture courses faculty listed specific courses related to:

1- Human Factors and behavior courses.
2- Sustainable Design courses.
3- Building Systems, Lighting, Materials courses.

DfSB is a cross-disciplinary area that pulls knowledge from behavioral science and applies it to sustainable designs affecting spatial solutions, furniture layouts, building systems, lighting and materials. Based on faculty testimonials of DfSB being integrated into all the areas above, it seems an infrastructure for teaching DfSB exists. However, based on the small amount of accurate definitions provided by faculty (section 4.3.1.1.2) and limited specific teaching resources cited for teaching it (section 4.3.1.1.3), a

discussion of how to capitalize on this infrastructure and overcome faculty members' limited familiarity is required. This emergent need is discussed further in a later section (7).

This section explored the current state of DfSB within ID programs and established that respondents accept DfSB basic tenets and have positive attitudes towards teaching it, despite overestimating their own familiarity with the field. There also appeared to be inconsistencies amongst faculty in the same institutions on the extent to which DfSB is offered in their respective programs. Nonetheless, faculty who indicated they offer DfSB implicitly in their program provided a reasonably accurate description of DfSB in ID programs. Their description suggested that despite the term DfSB not being present in ID education, its theoretical fields and components are taught in ID courses, but possibly without relating directly to sustainable behavior. This indicated an infrastructure for teaching DfSB exists along with positive attitudes from faculty members towards it which is a promising finding. Nonetheless, the following section examines potential barriers that could impede the integration of DfSB into ID in response to the second research question (1.3).

4.4. Identifying and Overcoming Barriers to including DfSB in ID

To address the second research question, namely; *what are the barriers to incorporating DfSB in ID and how can they be overcome*, the research compiled a number of barriers inspired from the literature and asked faculty to indicate whether they agreed they constituted barriers. These barriers fell into four categories: 1) faculty knowledge, awareness and perceived benefits of DfSB, 2) DfSB's complexity, process and ethical implications, 3) Stakeholders' interest in DfSB, and 4) availability of resources: research and curriculum capacity (Table 12). Respondents were also provided with a comment space to suggest other barriers or explain their selections.

Faculty				
	Disagree	Agree	Don't know	No Opinion
Not enough faculty members are aware of DfSB.	14%	53%	19%	13%
Interior design faculty lack the necessary knowledge to teach DfSB.	29%	43%	14%	15%
Teaching DfSB will not help me in my pursuit of promotions.	44%	13%	8%	34%
DfSB				
	Disagree	Agree	Don't know	No Opinion
DfSB is too specialized and therefore not suitable for undergraduate education.	80%	8%	4%	8%
The ethical implications of changing people's behaviors are too complex.	74%	8%	2%	15%
Applying DfSB requires access to occupants or users that is generally not available.	45%	23%	10%	21%

Interest				
	Disagree	**Agree**	**Don't know**	**No Opinion**
Interior design students are not interested in DfSB.	70%	14%	4%	11%
DfSB is not emphasized by educational or professional standards such as CIDA, NCIDQ, or LEED.	32%	32%	13%	22%
There are few opportunities for industry collaborations.	47%	15%	21%	18%
Interior design clients are not interested in DfSB.	53%	17%	15%	14%
Resources				
	Disagree	**Agree**	**Don't know**	**No Opinion**
There is not enough room in the curriculum to teach DfSB.	56%	28%	2%	15%
Not enough available research on DfSB in interior design.	22%	39%	18%	20%

Table 12- Faculty assessment of factors that could be barriers to teaching DfSB

Barriers relating to faculty (highlighted in grey in table) received the highest percentages indicating they constituted a potential barrier. They were followed by lack of sufficient research on DfSB within ID and a lack of emphasis placed on the topic from educational and professional standards. The latter was identified as a barrier by the same percentage of respondents' who did not perceive it as one and therefore warranted extra analysis. A discussion of educational and professional standards as a barrier along with all the proposed barriers and respondents' reactions to them is presented below.

4.4.1. Faculty knowledge, awareness and perceived benefit of DfSB

Three issues relating to faculty were explored in the questionnaire: 1) awareness of DfSB, 2) DfSB knowledge, and 3) impact on career advancement (Figure 20).
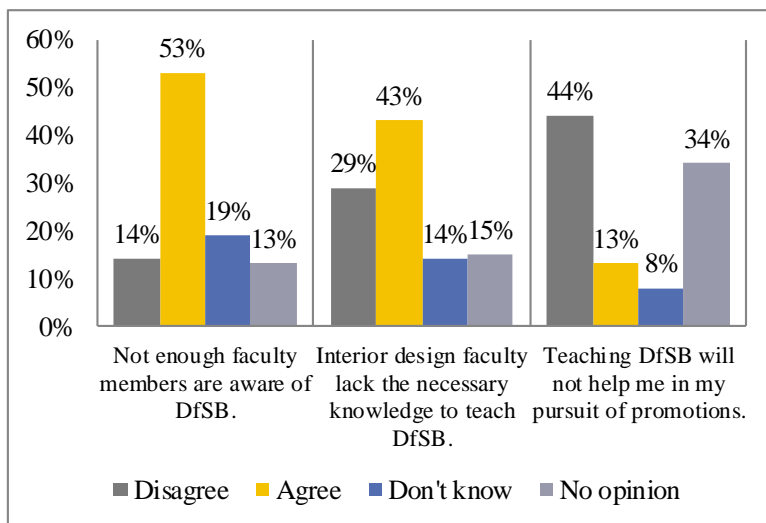

Figure 20 - Potential barriers relating to faculty

The most apparent barrier to teaching DfSB identified by respondents was faculty lacking awareness of the field (53%), followed by faculty not having the knowledge necessary to teach it (43%). These two

barriers were also mentioned in comments similar to the quotes below: (for an extended sample of comments pertaining to barriers see Appendix 8.9)

> "It is simply being aware enough of the subject to incorporate it into the curriculum."

> "One needs to be interested in presenting the information and requiring the students to consider these design parameters"

> "If a faculty member isn't interested in it, you can't force them. They have to wear lots of hats already, particularly in a public institution."

Unlike awareness and knowledge, the influence of teaching DfSB on promotions did not appear to create a clear barrier. Most respondents (44%) believed teaching DfSB would help in their career advancements while 34% did not have an opinion on the matter. This was the highest *no opinion* percentage amongst all the barriers. While many were uncertain, these results indicate that faculty believed teaching DfSB would not have a *negative* effect on their career advancement.

Both faculty awareness and knowledge of DfSB received the highest percentages of all suggested barriers, indicating they were probably the most prominent challenges to incorporating DfSB in ID. These barriers were further analyzed with interviewees in 5.2.2 and discussed in 7.1.2.

4.4.2. DfSB's complexity, process and ethical implications

In regards to the nature of DfSB creating a barrier, three issues were explored: 1) its level of specialization, 2) its ethical implications, and 3) access to occupants essential to DfSB's user-centered process (Figure 21).
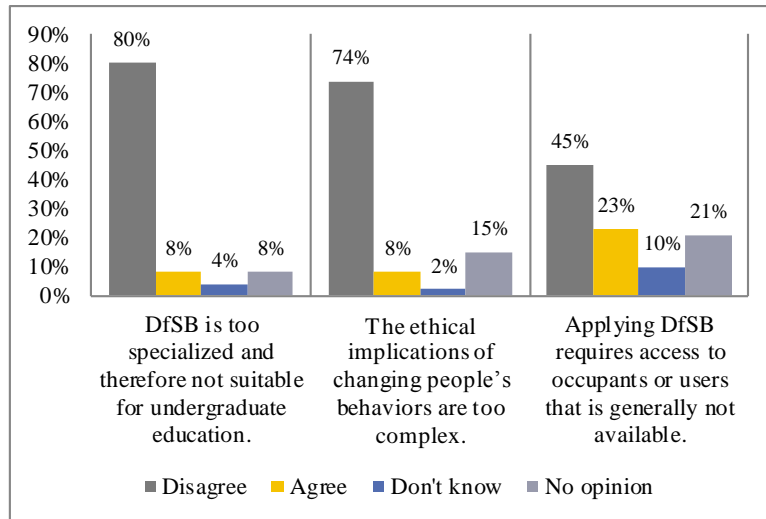
Figure 21 - Potential barriers that relate to DfSB's complexity

None of these three issues were viewed as barriers to DfSB integration, least of which was DfSB being too specialized as (80%) for undergraduate education. Similarly, 74% of faculty did not consider changing behavior through the use of design to be ethically complex to the point of creating a barrier. The ethics of changing behavior through the use of DfSB in ID is further discussed in two sections 5.5 and 7.1.3.

Access to occupants was not unanimously dismissed as a barrier compared to the two other proposed barriers. 31% of the sample indicated they either *did not know* whether or not it was a barrier or had *no opinion* on the matter while 23% did identify it as a barrier. This topic was investigated further during interviews during which interviewees shared different ways through which occupants/clients are involved in courses (5.3.1).

4.4.3. Stakeholders' interest in DfSB

Interest in DfSB was examined in relation to four stakeholders: 1) students, 2) education and practice standards, 3) industry, and 4) clients (Figure 22). Lack of interest in DfSB by students, industry practitioners or clients was not viewed as a barrier. On the contrary, it was apparent that faculty (70%) believed students are interested in learning about DfSB.
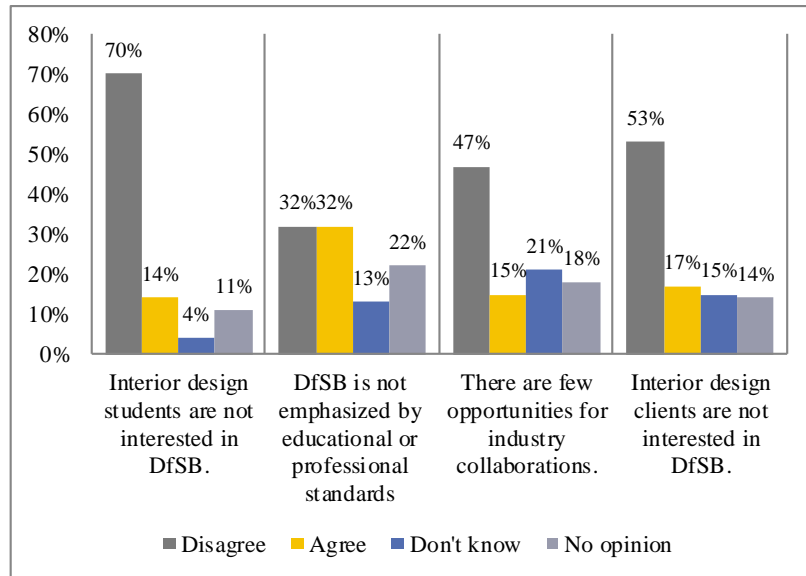
Figure 22 - Potential barriers that relate to stakeholder interest

In terms of collaborations with industry, 47% of faculty members did not view this is a barrier while 15% thought it may pose one and the remaining respondents either *did not know* (21%) or had *no opinion* on the matter (18%). Views were split regarding client interest in DfSB, with around half the sample (53%) indicating it was not a barrier and the remaining sample split between *agreement*, *not knowing*, and *having no opinion*. This may suggest faculty members feel optimistic in regards to teaming up with industry for the purpose of conducting research on DfSB which is a promising finding and was integrated in a later discussion (7.1.1).

However, when asked whether the lack of emphasis from CIDA[48] created a barrier to incorporating DfSB, an equal percentage of respondents identified it as a barrier as did those who did not (32%). One faculty argued that "promoting [DfSB] as one more 'CIDA standard' to add to the list would make it a barrier." This was mainly because some faculty felt CIDA is already requiring programs to include a lot of topics as demonstrated in the following comments:

"[DfSB would be] hard to teach in depth at the undergraduate level because there are already so many expectations for course objectives from CIDA."

"Too many requirements by CIDA limit any flexibility in curriculum"

"Realistically, for the undergraduates, the trend has been for fewer course credit hours and more complex content required by CIDA. Combined with the industry requirements for technology expertise (Revit, CAD, Adobe software, etc.), it is a challenge to address all that would be applicable. More possibilities exist at the graduate level when students can specialize."

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[48] Council for Interior Design Accreditation.

"There could always be more and stronger emphasis, but what would we eliminate from our current content to increase the amount of sustainable behavior?"

As respondents appeared to be mixed on the role CIDA can play in integrating DfSB, with some perceiving emphasis as a barrier and others not seeing it as such, (CIDA)'s role in integrating DfSB into ID education was further investigated through interviews (5.4.2).

4.4.4. Availability of resources: material and curriculum capacity

Resources as a barrier were examined in terms of 1) curriculum ability to accommodate DfSB and 2) availability of research on DfSB within ID (Figure 23).
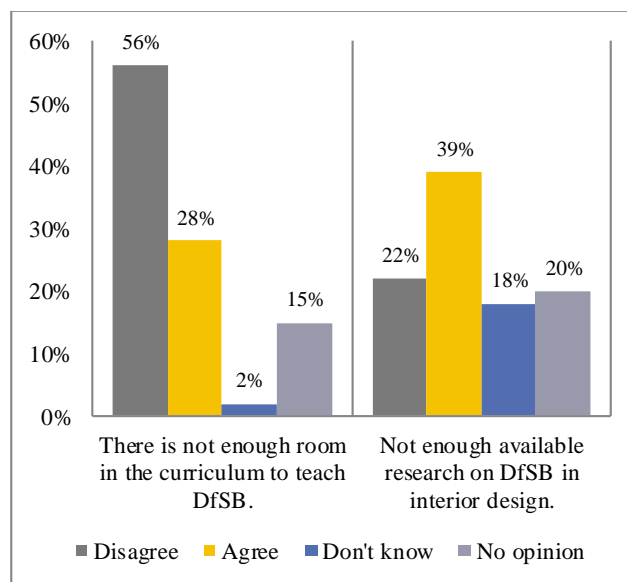

Figure 23 - Potential barriers that relate to resource availability

56% of respondents believed there was enough room in the curriculum to teach DfSB while 28% disagreed. This contradicts previous comments indicating ID programs are overcrowded due to CIDA requirements. On the other hand, many respondents (39%) considered lack of research on DfSB to be a barrier; however, 22% did not view it as such.

Faculty reiterated their belief in research shortage creating a barrier in the comment section allocated to the question in the questionnaire (Appendix - 08.9) along with pointing to other concerns as discussed in the following section.

4.4.5. Additional barriers

In the comment section faculty were asked to include any other barriers they believed hindered DfSB's integration into their programs. 46 comments[49] were analyzed for common themes; seven emerged in varying percentages as demonstrated in Table 13:

	Category	Percentage
1	Human-centric barriers: laziness, resistance or lack of interest from faculty, students, program leaders	23%
1	Lack of research and resource	23%
2	Overcrowded curriculum	19%
3	Other	13%
4	Time	12%
5	Cost	3%
5	There are no barriers	3%

Table 13- Additional barriers identified by faculty

The highest percentage of comments listed human-centric issues as barriers to DfSB integration in ID. These issues included 1) faculty awareness and interest, 2) some faculty holding a limited or outdated vision of what ID should encompass, 3) along with unsupportive leaderships such as program or department leaders. Some faculty focused on DfSB requiring a "culture shift" away from ideas shared among "skeptics (generally technologists) who think that user behavior makes minimal to no difference in the performance of the building." An equal percentage of comments pointed to the lack of sufficient research and resources available on the topic. This was followed by curricula being too overcrowded with essential knowledge and CIDA requirements that including DfSB may be too difficult. Additionally some respondents felt DfSB would be more appropriate for graduate studies.

Faculty also added two new barriers that were not included in the multiple-choice portion of the question, namely; time and cost. It was presumed that time related to credit hours, CIDA requirements and overcrowded curriculums. It could also pertain to faculty not having enough time to learn about this topic and then make changes to their course syllabi. There were also concerns regarding initial costs, which one comment related to technology but cost may also be associated with text books, equipment for measuring building performance, outcomes of a design intervention, or software packages.

A number of comments presented a range of thoughts that did not fit into any one category; they mentioned the need to make DfSB more explicit within ID courses that already include it, encouraging

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[49] A total of 65 respondents wrote a comment however 19 were excluded from the analysis for containing comments that related to DfSB in general or contained comments like "no," "NA," or "I don't know." Some comments included more than one suggestion which resulted in 52 items that were analyzed and collated into themes.

design firms to explore and become role models in the area, the image as projected by the media (HGTV) of ID was found to be a barrier by one respondent along with other comments that can be found in Appendix 8.9.

4.4.6. Removing a Barrier

This researcher anticipated the lack of faculty knowledge on DfSB may be a barrier to incorporating it in ID programs and accordingly included a question on how this barrier may be overcome. Faculty were asked to rate the effectiveness of various forums at increasing their knowledge of the area. All of the forums suggested were found to be effective (Figure 24), however faculty had some comments pertaining to dedicating conferences to DfSB and offering certification programs.
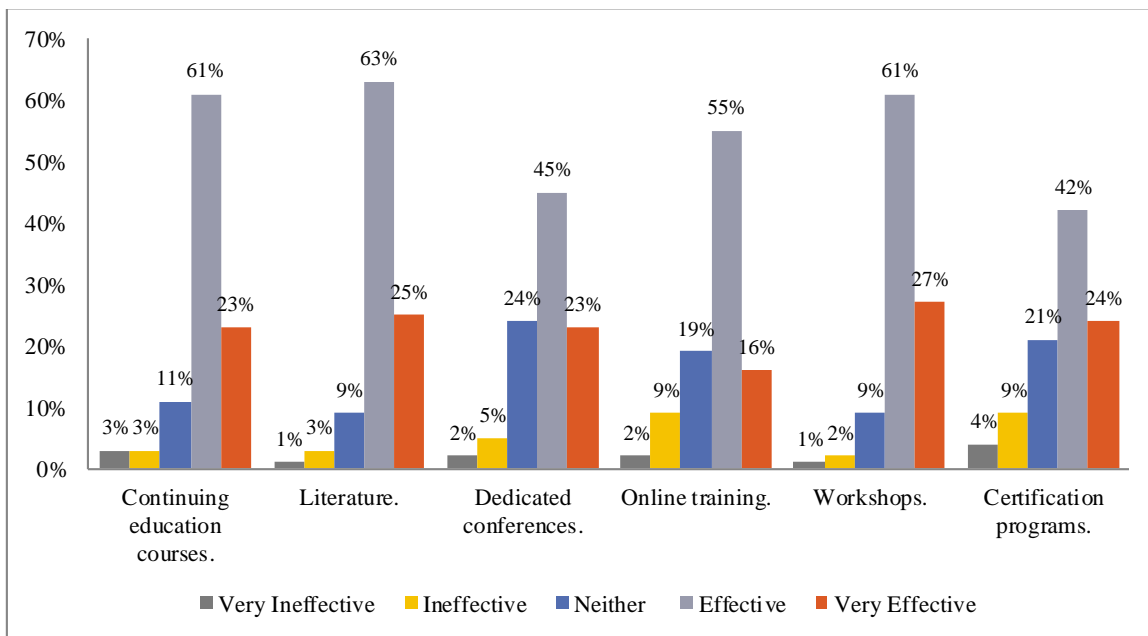

Figure 24 - Effectiveness of educational forums for faculty

In regards to conferences, faculty preferred it if DfSB were incorporated into existing conferences such as IDEC[50] or EDRA[51] instead of being offered in a dedicated conference. A broader conference as opposed to a specialized one attracts a large array of participants who can then be introduced to DfSB through panel discussion and presentations. This helps introduce DfSB to a larger group of faculty members.

The problem identified in relation to creating a certification program dedicated to DfSB was the cost that would be associated with it. Some faculty felt there were already many certifications interior designers need to pursue and the fees associated with them can at times create a financial burden. People may opt-

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[50] Interior Design Education Council
[51] Environmental Design Research Association

out of enrolling in yet another certification, even if they are interested in learning more about DfSB. This was similar to comments made by ID faculty interviewed by Crane (2008).

Both sections 4.3 and 4.4 demonstrated there is a great deal of interest in DfSB and desire to see it in curricula. There were some perceived barriers, most dealt with the need for additional faculty knowledge about DfSB, lack of research and the pragmatics of faculty time and space in the curricula. Nonetheless there seemed to be enough support for overcoming them as respondents' suggestions above demonstrated. This along with establishing an infrastructure for teaching DfSB currently exists in ID education suggests ID programs can accommodate DfSB. What, however, should a DfSB education in ID encompass? This question is examined in the following section.

4.5. DfSB Content and Teaching Methods: ID faculty members' suggestions

In addressing the third research questions, namely; *what should an interior design education encompassing DfSB include and how should it be taught*, faculty were asked to 1) indicate their satisfaction with the current state of DfSB within their programs, 2) suggest ways of improving its presence, 3) evaluate the importance of different DfSB content, and 4) identify appropriate teaching methods.

4.5.1. Satisfaction with Current State

About half the respondents indicated they were somewhat satisfied with DfSB's education within their programs while 31% were either satisfied or very satisfied and only 18% were dissatisfied (Figure 25).
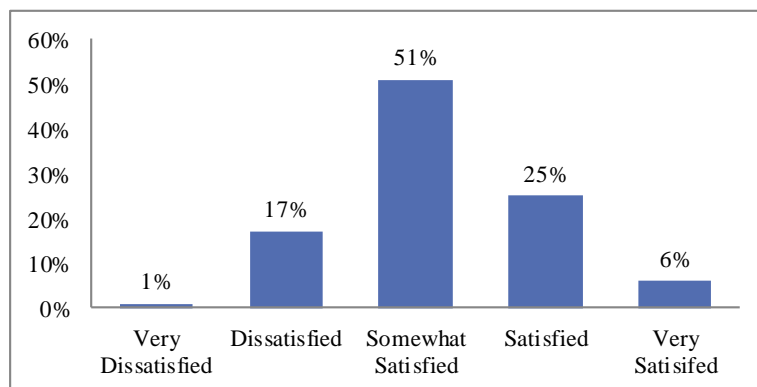

Figure 25- faculty satisfaction with DfSB education in ID

These numbers are encouraging as they indicated ID programs are acknowledging and teaching DfSB, they also demonstrated faculty are open to improvements, which gives findings from this research a better

acceptance probability. One faculty even indicated they were less satisfied with their program's work on DfSB after taking this questionnaire. What then would faculty improve if they could about teaching DfSB? The following section explores faculty suggestions.

4.5.2. Improving DfSB in ID

Suggestions for improving DfSB in ID were collected in two forms through the questionnaire; the first was an open ended question that asked for general and overarching suggestions and the second specifically asked faculty to indicate the content they believed should be included along with appropriate teaching methods for delivering DfSB content.

4.5.2.1. Overarching Ideas

In an open-ended comment space 102 individuals made suggestions for improving DfSB within ID programs. Their comments were coded and analyzed for themes. Two types of answers were excluded from the analysis, namely:

1- "not sure" and "need to think,"
2- non-descriptive answers such as: "more emphasis," "more examples," "broaden understanding and application"

The remaining 79[52] answers fell into seven main themes:

	Category	Percentage
1	Explicitly use the term and emphasize DfSB within existing courses	60%
2	Increase faculty knowledge and belief	13%
3	Individual suggestions	8%
4	Initiate research in DfSB	7%
5	Develop a throughout curriculum with measurable outcomes	5%
6	Emphasize the importance and inclusion of social psychology	5%
7	No improvement needed	2%

Table 14- Faculty suggestions for improving DfSB education

About 60% of responses advocated more explicitly identifying and offering DfSB and incorporating it overtly and clearly into the curriculum and its courses. Some respondents leaned towards making it more explicit within studios and projects while others were in favor of emphasizing it through theoretical, behavioral and sustainable design courses and studios that already explore it. There was a general

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[52] A total of 84 items were identified in the 79 comments as some entries included more than one suggestion.

consensus that programs should "name [DfSB] more explicitly in the curriculum," "make it more deliberate," and "make it a more intentional topic to be addressed."

The second suggestion related directly to faculty knowledge and adoption which as indicated earlier was amongst the most prominent barriers respondents identified to incorporating DfSB (4.4.1). Some faculty expressed this opinion through the following comments:

> Faculty needs training. I am a LEED AP and teach the sustainability courses in our department and I've never heard of 'Design for Sustainable Behavior'
>
> I talk about/work with sustainability issues in almost all of my courses, but I haven't been aware of the specific research being done on affecting human behavior.
>
> More faculty members need to understand this deeper level of sustainability. I feel like a lone wolf on this knowledge.

The third largest percentage comprised a number of individualized suggestions like brining in experts to speak to classes, providing precedent and evidence on DfSB and designing studio projects that revolve around DfSB strategies. These were followed by comments that suggested the need for initiating more research. Some faculty members requested more thought out curriculums that allow for identifying objectives and tracking outcomes:

> "We could be more specific about measuring learning outcomes related to design for sustainable behavior in our courses."
>
> "More apparent in goals and tracking for outcomes."

A few respondents stressed the importance of emphasizing the link DfSB has with environmental and behavioral psychology with one faculty member suggested offering a "multi-disciplinary course [made] available to more students." The importance of better emphasizing social science courses within ID particularly for the benefit of DfSB is discussed further in 5.2.5.

4.5.2.2. Specific suggestions: content and teaching method

Faculty were in favor of using a variety of methods to offer DfSB, the most popular being the use of *case studies* followed closely by *lecture courses* and *studio projects*, on the other hand, *working with occupants* was the least selected method receiving an average of no more than 11% of selections (Figure 26).

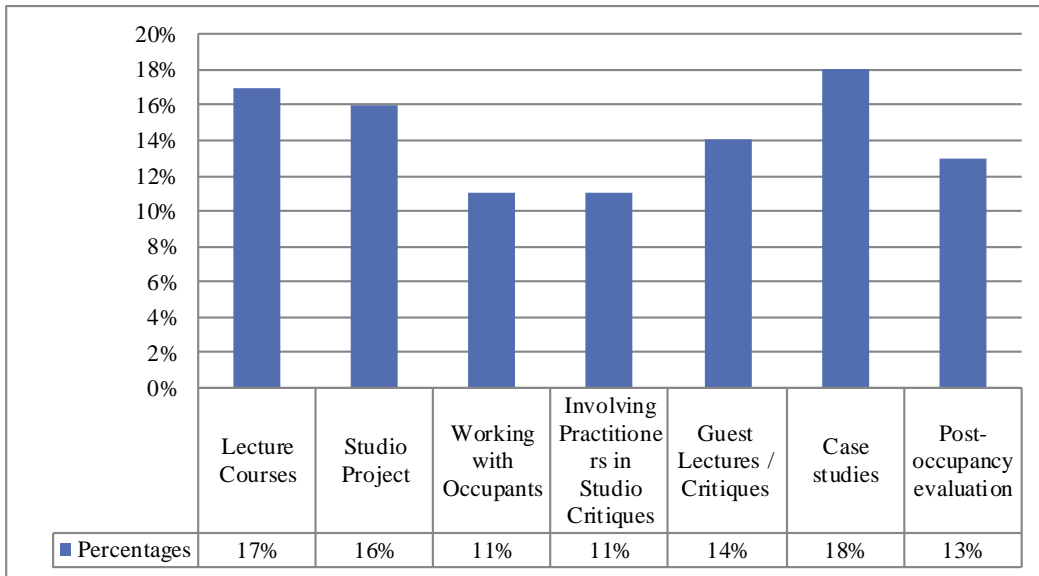|	Lecture Courses	Studio Project	Working with Occupants	Involving Practitioners in Studio Critiques	Guest Lectures / Critiques	Case studies	Post-occupancy evaluation
■ Percentages	17%	16%	11%	11%	14%	18%	13%

Figure 26- Approaches faculty believe would be most effective at teach DfSB

Certain methods were thought to be more suitable for particular components as demonstrated from faculty selections in Figure 27.
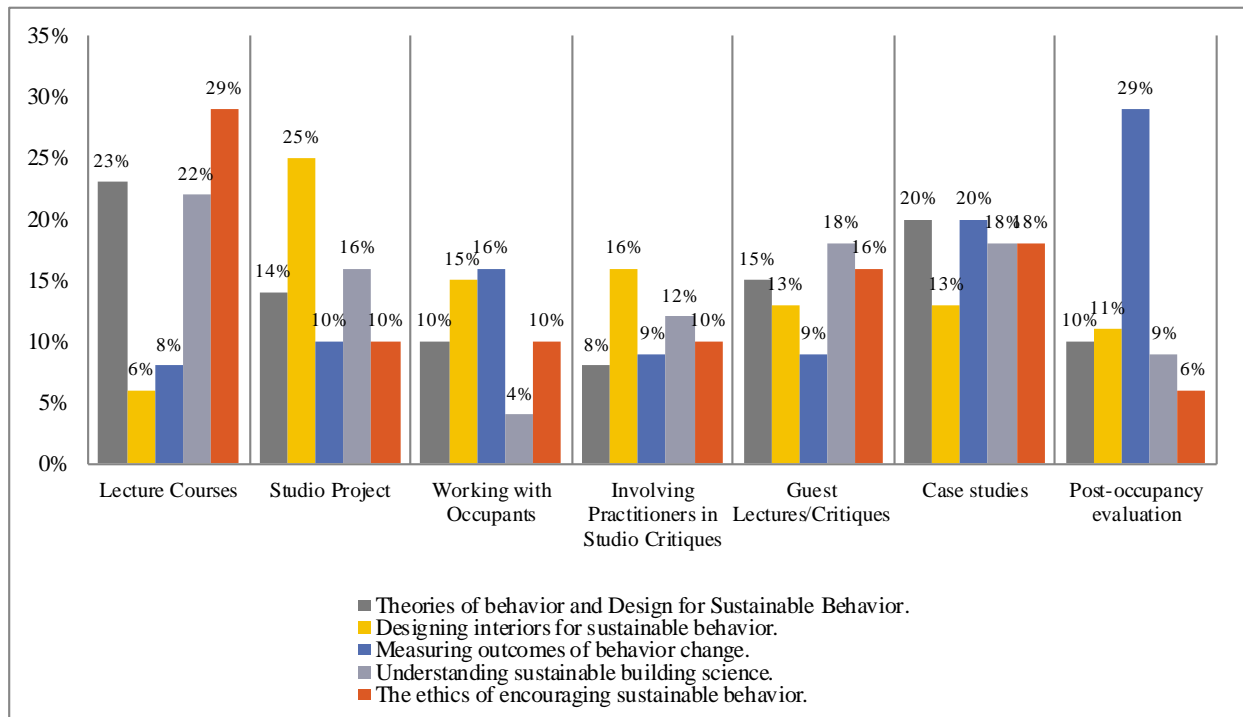

Figure 27- Approaches faculty believe would be most effective for teaching DfSB by content area

Although a mixture of methods can be used to teach the same DfSB component, faculty seemed to advocate the use of one or two methods over others for each component as demonstrated in Table 15.

80

	Topic	1st preferred approach	2nd preferred approach
1	Theories of behavior and DfSB	Lecture courses (23%)	Case studies (20%)
2	Designing interiors for sustainable behaviors	Studio projects (25%)	Involving practitioners (16%)
3	Measuring outcomes of behavior change	Post-occupancy (29%)	Case studies (20%)
4	Understanding sustainable building science	Lecture courses (22%)	Case studies (18%)
5	The ethics of encouraging sustainable behavior	Lecture courses (29%)	Guest lecturers (18%)

Table 15- Faculty's top choices for teaching DfSB content

Case studies, also referred to as precedents, are often employed by interior designers in education and practice (Lawson, 2005) which could explain why it was one of the preferred method of teaching different topics. Case studies can refer to precedents specifically related to DfSB in ID, or precedent in DfSB regardless of field. Considering DfSB has not yet been employed in ID projects, as indicated through faculty beliefs (section 4.3.1.3), it could arguably be difficult to rely heavily on this type of precedent at this stage. This could change as DfSB becomes more pronounced within ID. DfSB case studies untethered to ID are more readily available and can be elicited as needed, particularly as ID is inherently interdisciplinary and can adapt knowledge from various disciplines (Guerin & Thompson, 2004). It may be suggested that collating a body of case studies, particularly within the built industry, and making it accessible to interior design faculty is essential to furthering DfSB education and overcoming one of the barriers identified in an earlier section 4.4.4.

It was concerning however that working with occupants received the lowest percentage of selections when it should arguably be employed more widely. Working with occupants is critical to understanding and applying theories of behavior and for identifying unsustainable behaviors and the reasons driving them. Similarly, working with users through prototype testing and co-designing ensures design strategies do not influence behavior in a way users may find ethically questionable and may increase chances of users adopting suggested behaviors[53]. Challenges to incorporating users in an ID process as opposed to an industrial design process were discussed by one of the interviewees (chapter 55) in the following sections along with a number of other topics that complemented and added to findings from the questionnaire.

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[53] This is based on Cialdini's theories on influencing behavior within which he argued that when people make a public declaration involving a behavior they are more likely to commit to it. Being involved in a user-centered process where their needs and opinions are elicited and incorporated may be considered a form of public declaration and may accordingly increase the chances of users' changing their behavior (2007).

4.6. The Question of Ethics

As demonstrated in the literature review (2.4), the ethics of intentionally changing behavior through design is an integral part of DfSB's dialogue and proposed design processes (2.3.3). The question pertaining to ethics in the questionnaire was two-fold (see Appendix 8.3 for question). The first presented faculty with scenarios and asked them to indicate how ethical they felt each scenario was. The second part was an open-ended question that asked faculty to include any further ethical concerns they had to applying DfSB along with any reflections or comments on the topic. A discussion of the scenarios was not included in this document as the underlying beliefs on ethics were found to be more relevant at this point. Additionally, a number of respondents found the question was confusing and not well worded. With some expressing this opinion it made the researcher question the reliability of the answers and therefore opted to rely on opinions clearly articulated by the faculty themselves. An analysis of these opinions follows.

Of all the questions, the one regarding ethics drew the longest comments from participants and the language used was arguably more passionate compared to other questions. Of the 203 respondents, 40% (82) filled the comment section, 9 of these comments were excluded from the analysis because they commented on the questionnaire in general, or suggested educating clients about DfSB, or entered N/A. Of the remaining 73 comments, 35 only said "no" which left 38 comments for analysis. Of the 38 comments 42% (16) comments fell into three major categories (as listed in Appendix 8.10). The first was that applying DfSB would be encouraging a good behavior which makes DfSB ethical. The second was that design inherently influences behavior in all situations including those in which design is attempting to encourage people to be more sustainable. And lastly, participants felt the ethicality of DfSB depended on the type of strategy used within a given context. Below are samples of the comments provided within each category:

DfSB is a good behavior and therefore DfSB is ethical:

> "I can't see that influencing behavior to do something that is positive (recycling) could be considered unethical, even if it is encouraged without a person's knowing that they are being influenced in that direction. If you were encouraging a negative behavior (throwing the trash on the floor), that would not perhaps be "ethical" but more likely it would be described as unacceptable not unethical."

> "If you're implementing a design that improves human health by improving the air quality and quality of life in a building (which in inherent in sustainable design), then I don't think any occupant permission is necessary. Occupants may simply be uninformed and choose unhealthy courses of action due to their ignorance."

Design influences behavior all the time, DfSB is no different:

"What could be unethical. We influence behavior [behavior] in all our design solutions. What are you getting at?"

"I don't understand the problem here. In consumer behavior where the enviormnent [environment] and variables are manupulated [manipulated] all the time to evoke a behavior [behavior] of positive sales nobody asks people if they are OK with a particular color, or light level or music? if the designer meets the safety/comfort and space needs I think incorporating the sustainable ideas in a creative fashion to evoke positive behavior should be encouraged. I don't understand [understand] why the question of ethics comes in play here."

DfSB's ethicality depends on strategy and context:

"It was a bit difficult to answer the questions above because I think it highly depends on the design strategy -- some are more innocuous than others. Some strategies definitely need user input and others may not. When we implement highly deterministic features without consulting occupants, I expect there would be psychological reactance [reactions] that could compromise building performance (for example, if an occupant is angered and goes out of his/her way to be environmentally wasteful)."

"overthinking it! what matters it not the use of "Sustainable Behavior" but the level of control that is used."

A few (8%) faculty members argued design intervention should not harm.

"First, do no harm. Behavior change through design strategies do not always need to be consensual."

"As a designer there is a responsibility to educate the client of this topic to peak interest and forecasting the results of the design impact I presume the owner and occupant(s) and majority of the people involved would want to participate."

About 16% of the comments criticized the question itself for being confusing and not well-worded and the remaining 34% were a mixture of comments that could not be categorized as they expressed a range of opinions. For example, one of the comments claimed DfSB should not be part of the "issues that interior design industries should address," another argued DfSB could be linked to universal design with both becoming more normalized, and another comment warned against using deception in the form of penalties under the pretense of sustainability when they are meant for financial gain (for all these comments see Appendix 8.10).

Questionnaire responses provided insights into faculty members' opinions on the ethics of changing behavior through design as well as the three other research questions. In order to clarify some of the responses collected and examine the research questions on a deeper level, interviews were conducted with a number of volunteers. Results from these interviews are presented in the following section.

5. Results: Interviews

The results from the interviews were organized in a manner that responds to the research questions (1.3) and compliments findings from the questionnaire. It accordingly begins by further analyzing DfSB current state within ID by collecting examples from faculty members demonstrating how DfSB concepts are presented in courses today. It then moves into a further examination of the potential barriers that could limit the integration of DfSB into ID covering issues that were identified in the questionnaire along with those that were only uncovered through interviews. From identifying barriers, this section moves into collating interviewee's suggestions on how to best integrate DfSB into ID. Next the interviews tackled ways of disseminating DfSB into ID education and industry by reflecting on the role academic institutions and industry each play in shaping education followed by an organization of participants' proposed methods to teaching DfSB. The final topic central to interviews was the question of ethics and how it relates to DfSB. Responses from the questionnaire along with interviews are presented together as part of a holistic examination of the topic.

5.1. Current state of DfSB

In response to the first research question, the researcher engaged interviewees in an effort to 1) examine the likelihood of ID faculty members embracing DfSB through further examining their attitudes towards it, 2) form a more detailed understanding of the DfSB components taught in ID, and 3) reflect on the lack of DfSB presence in ID online material.

As positive attitudes amongst faculty members are essential for the adoption and inclusion of DfSB in ID programs, follow-up interviews discussed this aspect further by asking participants to elaborate on the importance of DfSB for ID. All eight interviewees agreed DfSB can be very important and, as interviewee (B) argued, "entirely in our domain and we have the potential to make a difference whether we are asked to or not as interior designers."

Interviewee (E and F) found that DfSB is important for shedding light on the pivotal role occupants' play in building sustainability, for example, designing highly technological solutions that people don't understand will not be affective without engaging and educating the user.

> "We're designing these technological intelligent buildings but there is this important piece of engaging the user". (E)

> "If the public doesn't know how to use [efficient technologies] then it isn't probably going to be effective". (F)

Both interviewee (B and E) found DfSB to be particularly relevant to ID because both ID and DfSB focus on people and their experience "more so than some of our friends in architecture" (E). Faculty (G) also pointed out that DfSB is not something that interior designers can ignore because things are changing in the sense that fields such as architecture, interior design and industrial design are "merging." Interview (C) elaborated on the link between the fields of interior and industrial design by explaining that as interior designers "probably a lot of what we do is pick out products whether furnishing or finish" which are "often times by industrial designers." With fields merging and interlinking, faculty (G) thinks interior designers will have to know how to talk to all these different design fields and will also need to design spaces that understand and can respond to them.

Another reason interviewees offered for the importance of DfSB to ID was that it already exists within what interior designers do, according to faculty (G) who argued taking "into account how people are going to behave in space" is inherit to what interior designers do. As such, interviewee (G) saw strength in introducing DfSB to ID because using the term: DfSB gives a name to something that (G) believes interior designers do intuitively. Intuition is hard to explain, teach and measure, she explained, however giving something intuitive a term helps designers justify their decisions in a measurable manner.

Interviewee (B) explained that in her program "I don't think that we talk about it that directly, (…) I think we don't do it intentionally enough." Faculty member (D) iterated this thought by stating "we would mention these things but it's almost in passing" Similarly, faculty (H) has heard of DfSB and is "particularly intrigued with it," however in her current program she believes "it's probably not consistently used across our curriculum."

The attitudinal question in the questionnaire (section 4.3.1.3) along with the interview responses have demonstrated faculty members hold positive attitudes towards DfSB and towards including it in ID education. Some interviewees also provided illuminating reasons as to why they believe DfSB is important to ID, with one faculty member arguing DfSB is intuitive to interior designers and already exists in courses. This was also suggested in questionnaire responses (4.3) and therefore warranted further exploration through interviews as discussed next.

In speaking with faculty the researcher was able to dig deeper and gather examples of how DfSB as a topic is tackled in ID. Interviewee (E), whose research interest fits within the area of design, behavior and sustainability, shared her experience trying to bring in her own research and passion into courses. Unfortunately, she said her research "just kind of falls flat with [students] and the reason I think is because it takes more foundation to really grip what I am trying to encourage them to do." The "foundation" interviewee E was referring to pertained mainly to knowledge from the social sciences

including psychological and environmental theories[54]. However, as faculty (E) continued to think through answering the interview questions, she realized DfSB is probably brought into the conversation within her current project, a farmer's market, in one form or another:

> We're working on the behavior change towards local food purchases, etc., so it's absolutely part of the conversation.

She still shies away from bringing in her research in its fullest to undergraduates due, again, to her belief of their being too much of a gap between the knowledge they have and the knowledge they would need to be able to grasp and apply information from her research pertaining to DfSB.

Similarly, faculty (B) spoke of topics within the building systems course that encourage students to think about small things like "where is the thermostat located and is it manually controlled, or digital or remote." Faculty (C) led a studio project that used spatial design as a means to encourage sustainable behaviors, particularly; recycling. Students were urged to think through locating recycling bins and considering the distance and path each employee would have to take in order to reach the recycling receptacles in an effort to make the behavior easier and consequently more frequent.

Issues relating to behavior and sustainability are also brought-up with students when discussing material selections. During these discussions, faculty member (C) stresses the importance of considering the role of environmental services crew[55]" in a building's sustainability. In her courses, students are taught the importance of adequately selecting materials that meet client needs. If a material specified does not work for the client they may end up replacing it with a new one which is a wasteful behavior. She also uses healthcare as an example where cleaning surfaces with bleach is standard procedure. If a designer would like to keep these chemical from getting into the environment they specify materials that have inherent qualities in them so that they don't need to be cleaned with such harsh chemicals. This however would need to be communicated to the maintenance and cleaning crew to insure they use appropriate cleaners and not just those they are used to. Such discussions arguably fall within DfSB strategies of informing and enabling users to create behavioral change (see literature review for a survey of DfSB strategies in section 2.3.2).

Interviewee (A) brought up the same observation on the importance of "bringing in multiple level players" including the maintenance crew early on. She remarked using an example from her own experience working in healthcare the opinions of doctors and designers are often valued more than other

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[54] Lack of sufficient foundation in the social and behavioral sciences within ID education was identified as a barrier to integrating DfSB through interview discussions, and is discussed in section 5.2.5.
[55] Also referred to as maintenance and cleaning crews.

key players such as maintenance and facility mangers. Faculty (A) however does not believe marginalizing other groups is helpful, particularly the maintenance crew as she thinks "a lot of the behaviors that are unsustainable happen in just maintaining the spaces." To overcome this, key players should be involved from the beginning through interviews and questionnaires to gain a holistic understanding of needs and suggestions from which to propose an appropriate design. ID faculty advocating the involvement of multiple stakeholders in the design process indicates their willingness to employ a user-centered design process which is quintessentially part of the DfSB process.

Even when courses do not include DfSB some students may bring its concepts in through their own work. Interviewee (H) noticed a "huge number of students have focused their capstone work on projects that have very distinct sustainability goals and … the idea that we are finding ways to help individuals make appropriate choices or make sustainable actions possible." This supports findings from the questionnaire that claimed students are highly interested in DfSB (4.4.3).

Despite positive attitudes towards DfSB and some faculty members teaching components of it to their students, no mention of DfSB in ID programs' online material was found (see section 4.3.2). This finding was examined during interviews as the final topic concerning DfSB's current state within ID (the first research question). When discussed with faculty members during the interview phase of this research, none of the eight interviewees found the lack of DfSB presence in online material surprising. The first reason offered was that faculty members' lack knowledge or awareness of DfSB. This was suggested by interviewee (C) who did not find the lack of DfSB presence in online material surprising because, as she explained, she'd "never seen the direct connection" between design and behavior.

Interviewee (B) also offered another explanation using her building systems course as an example. She argued her course content may touch on topics relevant to DfSB like thinking "about energy sources and how building systems are monitored," or issues such "as where is the thermostat located and is it manually controlled, or digital or remote." These topics however would not be described as DfSB in the syllabus; rather they would fit "under that larger category of designing sustainably." Faculty member (G) suggested online material is intentionally kept general to give professors the flexibility "to teach what they need to teach."

Both interviewees (B and G) therefore think it is possible that aspects of DfSB are included in current courses despite there being no clear reference to the topic online due to the nature of writing online material. Interviewee (H) agreed with this assessment and offered another reason that related to faculty members being overwhelmed with everything on their plate which prevents them from tracking their online publications often enough to reflect new topics or changes occurring.

Interview answers supported questionnaire findings that demonstrated 1) ID faculty hold positive attitudes towards DfSB (4.3.1.3) and 2) are currently teaching aspects of it in their courses (4.3.2.2) despite 3) DfSB as a term not being used in courses or online literature (4.3.2.1). Interviews elaborated on these findings by presenting some of the reasons ID faculty believe DfSB is important, along with providing a clearer vision of the angles through which DfSB is explored and some of the struggles faculty dedicated to design, behavior and sustainability are facing when attempting to introduce this complex area to undergraduates.

The following section explores potential challenges to incorporating DfSB into ID. The questionnaire asked participants to indicate barriers to incorporating DfSB into ID with the major threat appearing to be lack of knowledge and awareness of the field. Interviews investigated these barriers further by first re-posing the question; what are the barriers to incorporating DfSB into ID and then asking faculty to explain some of the questionnaire's findings.

5.2. Barriers

The major finding arising from analyzing the questionnaire and interviews is that there is a great deal of interest in DfSB and desire to learn more about the area. There were, nonetheless, perceived challenges/barriers to integrating DfSB into ID education. None of the faculty interviewed however felt these barriers would prevent the adoption of DfSB. The following section will present these perceived barriers.

The first three barriers echo those identified in the questionnaire and were therefore discussed in greater detail with interviewees. The last two were only uncovered during the interview phase of this research and have added new insights and understanding.

5.2.1. Faculty members' belief and background

Despite the questionnaire demonstrating the majority of faculty hold positive attitudes towards DfSB and believe in its tenets (4.3.1.2), some interviewees did express concern over faculty truly believing in sustainability and by extension DfSB. A couple of interviewees shared their experiences with colleagues who either did not share their belief in the importance of sustainable design or who would express support for sustainability during conversations without translating their verbal declaration to projects within courses. Concerns over faculty adoption were also expressed during the interview particularly when respondents were asked to outline barriers in the comment section (4.4.5 and Appendix 8.9).

Of all the barriers, "belief is the most difficult" to overcome, according to interviewee (A), who has tried in numerous ways to encourage colleagues to adopt a deeper and holistic approach to sustainability within which DfSB, she believes, would fit. Nonetheless, she has found that unless a faculty believed in this holistic view they weren't directing projects within their courses to include it. Faculty (A) therefore believes one of the biggest challenges for DfSB is "adoption from the faculty, not just an agreement with, but a true adoption, and I think that it's missing." Faculty (E) was of a similar opinion having dedicated her PhD to the study of sustainability, behavior and design and found that "there really aren't a ton of faculty, when you look across all design and architecture faculty, there aren't a ton of us that are really passionate, like really passionate about this." Faculty (E) also provided a critical observation suggesting that some faculty members are still pushing back on sustainability itself, not merely in its deeper form, but in its basic form. She shared that some faculty members "actively push against [sustainability] because they worry it's going to degrade the quality of the design if students get too bogged down with technical things." With faculty adopting this anti-sustainability mindset faculty (E) is worried "we're going struggle to get this DfSB in design education because it's just, it needs the foundation."

None of the other interviewees expressed concern over sustainability itself being adopted; therefore, it is unclear how wide this phenomenon of pushing against sustainability exists within ID programs and how overt it is, if it all. This is however an important topic worth exploring in future studies.

The second attribute both interviewees (A and E) agreed affect faculty members' willingness to adopt and implement sustainability, and by extension DfSB, was each individuals' background and personality. Similar concerns were also mentioned by a couple of respondents to the questionnaire (Appendix 8.9). When discussing her experience with faculty adopting sustainable education in ID courses, interviewee (A) explained that "some faculty members seem to 'get it,' while others may believe in it, but their behaviors are already 'set'. They are less malleable to a behavior shift." She explained; "younger faculty members were part of practice when practice approached things a little more sustainably (…) [and] have grown-up with conversations and behaviors leaning towards sustainable societies." On the other hand, "others didn't practice during that time or more than that don't have at home [sustainable] behaviors." This statement may suggest older faculty members either did not practice during sustainable periods or do not have "at home" sustainable behaviors. However, interviewee (A) was sure to clarify her opinion during the member checking phase (see methodology 3.2.3.2 for explanation) stating older faculty members do get sustainable design as well and that she did not mean to generalize such a comment. Similarly, faculty (E) did allude that generational differences affect an individual's adoption of sustainability and DfSB, but did not generalize her observation to a population beyond her personal

experience. Within the context of the particular department she was referring to, interviewee (E) explained:

> It has to do with the view point of tenured faculty from a different generation who have set the tone for curriculum and are very well respected by students and they don't teach it … In conversation, they'll agree this is important and yes this is one of our values, but if you look at what they're actually doing in the classroom or when they're making curriculum changes, it's never with this in mind

The limited number of passionate advocates, lack of strong belief and varying personalities and backgrounds were all viewed as major barriers that could obstruct the integration of DfSB into ID programs in both the questionnaire and interview responses. This suggests it is vital for any program aiming to incorporate DfSB to address them. Section 7.1.1 presents some ways of doing so.

5.2.2. Faculty members' lack of DfSB knowledge

The second barrier emphasized by both questionnaire and interview responses was faculty members' lack of DfSB knowledge which the questionnaire results have shown to be one of the largest barriers to incorporating DfSB into ID (4.4.1). Interviews showed the same results with interviewee (A) noting that even when faculty members do believe in sustainability and are willing to explore its theories and deeper meanings, including DfSB, "there is a gap between understanding the philosophy and really knowing how and what to do with the students to help them understand [it]." Interviewee (C), who had not heard of DfSB and had not seen the connection between sustainability, behavior and design before this study, believes "a lot of people know about LEED and health building guidelines but as far as how it effects behavior or interacts [with] behavior, I think that's not widely known." However, if this knowledge becomes available, she believes people would teach it.

When asked why the questionnaire showed many ID faculty members were not sufficiently familiar with DfSB enough to be able to define it closely, none of the faculty found that surprising, interviewee (A) sighed when this question was brought up and said "I would say it doesn't surprise me, it frustrates me but it doesn't surprise me."

Similarly, interviewee (F) was not surprised as the first time she had personally heard of DfSB was through the questionnaire. Interviewee (G) believes DfSB is inherent in what interior designers do, however since the terminology itself does not exist in ID that may have been why not many have heard of it or were able to accurately define it. Faculty member (E) suspects it may have something to do with each respondent's background and asked the researcher whether a large number of those who took the questionnaire held (PhD)'s in the social sciences (for a breakdown of respondents' PhD areas see 3.2.2) as

she could see those who do not have this interest in their background potentially "struggling a little bit with it."

Interviewee (B) attributed the lack of familiarity with DfSB to "a separation in disciplines, maybe not so much in practice, but certainly in education." Faculty (H) agreed and suggested it may be due to the nature of the academic system that often creates isolated faculty members working within their siloed research areas and interests. Interviewee (H) explained:

> Although we all work to a very broad curriculum and our job is to produce well-rounded designers, at the end of the day we all do that from our own little silos and individualized, unique research agendas. The whole idea of academia is that you find your area of research and you go very deep and it's very narrow that area of specialty.

As faculty members' limited knowledge of DfSB was identified as one of the most prominent barrier to integrating DfSB in the questionnaire (4.4.1) as well as the interviews, interview participants were asked to expand on ways of overcoming this barrier. Participants suggested a number of methods for increasing faculty members' knowledge and understanding of DfSB. Some limited their answers to methods similar to those proposed in the questionnaire such as publications, both online (websites) and in print (journals and magazines), and continuing education credits. On the other hand, faculty (B) suggested ID faculty could learn about DfSB through working with other faculty in the social sciences for example "so we're learning as we're doing, by collaborating." Interviewee (E) suggested identifying faculty members who teach human factors and behavior courses and "target them, maybe even share lesson plans or curriculum or literature on [DfSB]."

Similar to the idea of collaborating, two interviewees felt charrettes and workshops could give faculty a practical understanding of DfSB. Faculty (B) suggested organizing two-to-three day charrettes within universities for faculty to practice DfSB ideas and then share them with their students afterwards. Interviewee (E) favored offering a workshop within IDEC to raise awareness through inviting prominent DfSB researchers to present case studies and lead an open discussion with attendees. This is in-line with questionnaire findings that showed faculty members preferred including DfSB in existing conferences as opposed to creating conferences dedicated to DfSB.

More than anything, interviewee (G) believes integrating DfSB is similar to starting a campaign. Faculty (E) shared the same sentiment and argued that any department wishing to include DfSB needs to have "an advocate for it, just like any initiative you need to have at least one passionate person, otherwise your students will get through a four-year curriculum without it."

5.2.3. Overcrowded curriculum

Many questionnaire respondents did not believe current ID programs were so full that they could not include DfSB (4.4.4). However there were a noticeable number of comments that suggested overcrowded curriculums could create a potential barrier (see Appendix 8.9 for these comments). This along with three interviewees offering this as a potential barrier compelled the researcher to enquire further into this concern.

Faculty (H) explained there were two major forces simultaneously exerted on some ID programs, one to decrease and cut back on content and the other to expand and include more topics. Pressure to cut back on content is sometimes coming down from state legislators in an effort to ensure students graduate in less than four years and consequently "not accrue so much debt while they're in school." Students are exerting similar pressure not because "they're not interested in the material, it's just that it's not affordable to do it any other way." At the same time, there is professional pressure to add content that ensures students are keeping up with the growing and complex industry and its technological aspects.

According to interviewee (B), students are already interested in designs that incorporate deeper social and behavioral considerations, such as DfSB, "but they don't know how to make a living doing that (…) [and] how it can be more part of their design work." Additionally, faculty (B) argued although some firms are starting to do their own design research, students also need to be prepared "for working in more conventional practice and ways of thinking." Selling industry on DfSB is explored further in section 5.4 while an examination of the influence industry has, or should have, on education are presented in section 5.4.1. A discussion on how DfSB may be integrated into curricula while accounting for the concern of straining programs is discussed in section 7.1.1.

5.2.4. ID as an applied field

A barrier that was not mentioned in the questionnaire relates to DfSB's reliance on several theoretical fields (as explained in 2.3.1) which faculty members felt could cause a potential challenge, especially since most ID programs' adopt an applied teaching approach. In this applied method, interviewee (H) believes interior designers, unlike architects, "rarely talk about interior design's theoretical roots." Although it is not possible to generalize this to all ID programs, four of the eight interviewees did allude to the prominence of an applied method within ID without the researcher enquiring about the topic. Interviewee (H) felt it may be due to ID growing from a number of different fields:

> "We often don't spend enough time in the theoretical realm where we're talking about environmental theories, behavioral theories, and the fundamentals to our programs maybe

because we have grown out of all kinds of other forms and most of our educational programs have become applied professional programs".

When asked how DfSB should be introduced to ID, faculty (D) plainly preferred an applied approach mainly due to the school not being particularly theory oriented and students not latching on to theories as easily. Students' preferring an applied approach to ID was mentioned by a couple other faculty members as well, including interviewee (A) who expressed her concerns through stating "[Students] lean way toward the technical things and the theoretical don't ever really seem to land for them." Faculty member (F) also found students become used "to their design process" and meeting certain milestones at certain times which makes "slowing down and really relishing in the conceptualization phase" and going "deeper into the why of the psychological realm" difficult for senior students.

5.2.5. Lack of appropriate social science foundation

The second barrier not emphasized in the questionnaire came from a number of interviewees suggesting students are currently not receiving a strong enough foundation in the social sciences essential to DfSB because, as interviewee (H) stated, ID faculty don't spend enough time "talking about environmental theories, [and] behavioral theories." Similarly, interviewee (D), who was educated as an architect, argued there are a limited number of courses on behavior, psychology, and sociology required or offered in ID programs. Interviewee (D) remembered having to take a two semester long course on the psychology of environmental design. Whereas; for an ID program to achieve accreditation, (D) believes a program only needs to include one course that relates to environmental psychology, if even that. In the current program (D) teaches on, he believes they "don't have a course like that, it's an elective if anything."

Interviewee (B) was of a similar opinion pointing out that in ID programs "we're not making designers who are experts in any one thing, and they are skilled but not experts in human behavior." In order for students to be able to realize on a deeper level the effect of their design on behavior, faculty (B) believes "they would require more learning and more education."

The challenge really is providing students with all the "building blocks" (E) from social and behavioral sciences necessary for understanding and implementing DfSB without overwhelming them or straining the curriculum with more courses which can also create a barrier as discussed in 5.2.3.

Interviews supported questionnaire findings, clarified some of the nuances and added new insights to the research. As was concluded earlier (4.4.6), though the aforementioned barriers may present true challenges for programs attempting to integrate DfSB, they can be overcome especially since faculty members are highly supportive of DfSB. Having established positive attitudes towards including DfSB in

ID and collated potential barriers to its inclusion, the researcher then gathered faculty members' suggestions and insights on which components of DfSB they thought should be integrated and how, as explained next.

5.3. Integrating DfSB: content and teaching method

To establish a baseline from which to build future efforts for integrating DfSB, the questionnaire examined DfSB's current state through asking three main questions: which components of DfSB, if any, exist within ID (4.3.2.2.2), in which courses (4.1.2.2.3), and how can the state of DfSB be improved (4.5.2)? It was uncovered that DfSB components exist within ID education to varying degrees and are mainly covered during lecture courses and studios. Faculty also had a number of suggestions for integrating DfSB into ID which centered on explicitly using the term DfSB and increasing faculty's knowledge. During interviews, participants were asked to elaborate on ways of integrating DfSB through commenting on topics that were not included in the questionnaire. To identify what DfSB content to include in ID, an in-depth analysis of DfSB strategies, its user-centered design process and ways of identifying unsustainable behaviors was carried out with interviewees. Similarly, to identify appropriate methods for teaching DfSB faculty were asked to reflect on appropriate courses, integrating versus separating DfSB from other ID topics, and the advantages and challenges of teaching an interdisciplinary topics like DfSB. Findings are outlined in the following sections.

5.3.1. Content

As demonstrated in the literature (2.3), DfSB consists of theories, strategies and design processes. All three components form important content areas crucial for a DfSB education within ID. Interview participants were asked to assess these three components' applicability for ID education. When interviewees discussed DfSB theories however, it was within the context of where in the curriculum they should be introduced and will therefore be discussed in a following section that examines methods of teaching DfSB (5.3.2). Design strategies and processes on the other hand, were examined in terms of their applicability as content topics for ID students.

Faculty believed applying DfSB strategies within ID would be "wonderful," (B) "completely applicable" (E) and something interior designers should be "better at" (C). When asked whether some strategies (inform, persuade, determine) were more suitable for ID than others, two interviewees felt determining people's behavior through design will probably yield most results. This is in line with industrial designers' assumptions (see Lilley & Lofthouse, 2010a). Particularly for interior designers, interviewee

(C) thought determining behavior would be a better approach because interior designers "are only involved in the project for a small amount of time" and having strategies in place that determine behaviors ensures that they've designed a space that remains sustainable even after they've gone. Similarly, interviewee (H) believes determining strategies can "be very beneficial for really making change and building (…) habit" which is "a big part of any systemic change[56]." Nonetheless, faculty (E) expressed concern that such strategies communicate a sense of control and force which may push occupants to "over-ride the building" or choose to go out of their way to do the un-environmental thing. As such, both interviewees felt deterministic strategies should probably "be used judiciously" to avoid creating "irritation" and "resentment" (H).

Information and persuasion strategies were viewed as capable of "building long-term relationships with the ideas" (H) of sustainable behavior. Interviewee (E) said:

> "Because I am so deeply concerned about our environment , I am totally down with strategies that work under the radar and especially ones ... building occupants may not know about, they may not think their doing something".

Such an approach was favored by faculty, particularly when attempting to disseminate DfSB into industry as discussed in (5.4) where faculty suggest framing DfSB as supportive of behaviors, not controlling. Similarly, when discussing the ethics of using DfSB a few respondents demonstrated objection to using deterministic strategies (Appendix- 8.10). Of the eight faculty members, three were able to provide a well-rounded discussion of the strategies and their applicability in ID. The remaining five supported using the strategies in ID and expressed positive and excited sentiments but not a rationalized weighing and analysis of the strategies and their applicability. Both contributions (well-rounded discussion and positive sentiment) are encouraging findings that suggest faculty members of different knowledge levels are willing to embrace DfSB.

As for employing a user-centered design process (for definition see 2.3.1) similar to that employed in industrial design and DfSB, it was not clear from questionnaire answers how ID faculty defined or practiced user-centered design in their courses or the extent to which occupants are involved. This was due to the questionnaire design that needed to ask short questions and could not provide lengthy descriptions along with every question. Instead the questionnaire only asked participants if they included *designed with stakeholders* as a topic within classes they teach on sustainability and DfSB, and the extent to which they believed *designing with stakeholder* is important for DfSB education within ID. The

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[56] Habits are a very important topic within DfSB literature (Wilson, 2013 explored the role of habit in his research and pointed to others who have as well). ID faculty echoing this thought is a promising finding as it demonstrates awareness of factors that affect behavior formation and change.

researcher therefore decided while writing the questionnaire that a deeper discussion of user-centered design would be necessary during the interview phase. During the interview the researcher was able to share user-centered design's definition as applied in DfSB and asked interviewees whether or not they thought it was feasible within ID. Interview responses shed some light as to how users (also referred to as clients) are integrated into class projects with one interviewee supplying her views on applying a user-centered design process to ID.

Within the program faculty (A) is part of, "students (…) are actually talking with a client or have some sort of client profile," to understand who they are designing for. Interviewee (A) did not indicate however whether clients were involved in the design process beyond being present for the final presentations of student work. Involving clients depends on each professor according to interviewee (H) and the connections they make off campus. Even when real clients are not brought in for projects, faculty members do try to bring in experts that act like clients.

However, user-centered design that places the user at the center of the design process while the designer assumes the role of a facilitator was not thoroughly discussed by any of the interviewees except faculty (G). Interviewee (G) gave the most detailed discussion of DfSB's user-centered process as she has had professional work experience working in a design build firm that exposed her to designing products. In her opinion there is a difference in scale and complexity between architecture, interior design and industrial design that affects the extent to which clients can be involved in the design process. She argued end users can be much more involved in the product design process than that of interior spaces or architectural projects. Based on experience, interviewee (G) believes user-centered design used by industrial design is not possible in interior design and architecture because industrial designers creates an object that can, for the most part, feel accessible to clients which makes it possible for them to understand it and critique it. Buildings on the other hand are more complex and require the clients trust the design team they hire. Clients "don't know how to critique a building they don't know how to make a building so there is a level of trust that they put in their designer and architect."

In discussing DfSB's process another topic was brought up with interviewees, namely; how can interior designers identify unsustainable behaviors to target for change. Most, if not all, DfSB design processes begin by designers identifying an appropriate unsustainable behavior to target for change through design (2.3.3). Interviewees were asked to suggest methods for identifying unsustainable behaviors within the built environment to ensure these methods are incorporated into a DfSB education in ID.

Traditional observations were suggested by two faculty members with (A) remembering having spent three and a half hours out in a plaza during her undergraduate degree observing people's behaviors as part

of a studio class. This exercise, faculty (A) believes, is "probably underutilized" today, it can however help designers "know what areas were most used, what areas were least used [in a space and] what factors within a space influenced behavior." Although this may be "an old school method" as faculty (A) described it, she does believe observation is "key" to identifying unsustainable behaviors. Interviewee (B) also suggested observations; however she advocated using technologies and monitoring systems for carrying out observations as that would be more cost efficient. Faculty (G) agreed with (B) and suggested collecting data regarding behavior patterns within buildings, to then modify what needs to be modified.

Interviewee (H) believes the first step for identifying unsustainable behavior may be collaborating and reaching out beyond ID to those with "some real understanding of building science and building systems" as she doesn't think ID students would be able to accomplish this task on their own. She also advocated pulling in clients so that they could "participate in making decisions and prioritizing" which behaviors should be targeted for change. Interviewee (H) pointed out the importance of measuring and communicating results so that designers can produce a "feedback loop" that gives "people a sense of their progress." Faculty (B) also stressed the importance of documenting and analyzing data and suggested such a step should be part of DfSB studio projects.

5.3.2. Methods

When discussing appropriate methods for teaching DfSB most faculty members agreed theories of DfSB should be introduced before the practical aspects of the field in a curriculum. Faculty (E) argued getting at the "kind of depth of thought" required for DfSB can only happen in later studios after students have completed courses on "environmental behavior" and "green building" and faculty have been able to "stack them up together and then work on a synthesis."

The question of whether DfSB should be introduced as a separate topic or integrated into several courses stirred up different responses. On the one hand, faculty felt it was important DfSB is "not taught solely in isolation from good design" (B). On the other hand, faculty (B) was also worried:

> "Unless we look at it in a more targeted way, (…) where we actually call it DfSB, and talk about it [in] a direct way, that we're probably not going to get to a vision where it's comprehensive and assumed".

Interviewee (H) also preferred an integrated approach but for a different reason. She suggested integrating and reinforcing knowledge at different points throughout the curriculum as a response to one of the problems faculty have faced, namely; students, particularly millennials, compartmentalizing information they gain from classes. The program is trying to overcome this through "delivering the material in smaller

snippets. That will continually reinforce the issues and let us get increasingly more complex." She also suggested using a module system to deliver DfSB and explains:

> "It would be really nice to have theoretical seminar workshops alongside [the studio] (…) [as] a reminder of behavioral theories. That might be helpful as they're designing new spaces for people around the topic".

Interviewee (A) observed the same student tendency not to carry information from one course to the other in her program and therefore she too believes it is important to integrate DfSB at multiple points starting off with its main concepts then building on that "in a research studio." This is similar to Crane's (2008) finding discussed in (2.2.1)

When asked to list current courses within which DfSB could be integrated, interviewees offered several examples that fell mainly under three types: 1) theory-based classes like human factors and design thinking, 2) building systems and 3) studio. Although interviewee (E) was very enthusiastic about DfSB, given her similar research interest, she stated:

> "I struggle to see how departments would make it a whole required class but I could easily see it, and what it absolutely needs to be, is a unit within every environmental behavior class".

The idea of incorporating DfSB into existing behavioral and human factors courses was echoed by a number of other faculty members. Interviewee (F) gave an overview of the topics covered in her program's human factors course which includes basic anthropometrics and universal design[57]. She sees an opportunity for taking the topics within the current course deeper and including DfSB's main question: "how do you encourage and evoke users to use [spaces] in mindful ethical ways?" Faculty (C) pointed to a critical thinking course in her program offered to ID major and non-major undergraduates where students are taught how to space plan and select materials. Faculty (C) believes DfSB can offer a "justification of why you do what you do." This notion of DfSB offering justifications was identified by other faculty as one of the strengths introducing DfSB into ID could bring (4.3.1.3). Interviewee (B) wasn't sure if her program's current design thinking course incorporates DfSB but believes it also presents "a great opportunity to integrate more of [DfSB] thinking."

Interviewee (D) suggested a different type of courses for the inclusion of DfSB, namely; courses on the technology of the built environment. Faculty (D) stated:

> "I think [DfSB] could fit pretty well there and I think you can use technology to help you in creating a better sustainable behavior".

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[57] This list of topics matches finding from this researcher's survey of top ID programs which revealed similar topics exist within human factors courses in ID as demonstrated in section 4.3.

Studio was the third existing class within which faculty believed DfSB could fit as faculty (B) pointed out in the quote below.

> "I would imagine (…) we can have studio projects that are specifically around the topic and are tailored to it. This is a fantastic way to address it because you could have more time for investigation and questioning".

Faculty felt DfSB could have an entire studio project dedicated to it be integrated as a component of any existing studio project as suggested by interviewee (B).

Interviewee (B) suggested easing students into DfSB through offering it as an elective for those with a particular interest or through charrettes. Faculty (H) imagined organizing an annual event where a large scale charrette would engage students from different years and majors along with faculty in a "very creative and fun way" instead of DfSB being "one more class" that students simply "have to take."

A methodological challenge, which was not touched upon in the questionnaire, was posed to faculty members during the interviews, namely; how can DfSB, an inherently interdisciplinary field, be taught within ID and by ID faculty? Reaching out to faculty from other disciplines and seeking out collaborative opportunities were suggested by interviewees. Interviewee (B) suggested ID programs that have faculty members with the experience and the expertise in DfSB can be asked to co-teach or serve as consultants on different projects. She also advocated reaching out beyond design and architecture to other disciplines, saying:

> "One of the huge benefits in my mind, why I love working in a university, is that we have the benefit of all of these other disciplines … we can actually have, not only faculty collaborating to design coursework or to do their own individual research, but to actually teach the classes and have the students working together".

It is likely other disciplines might be just as willing to collaborate with ID as interviewee (E) has found in working on her own research that environmental psychologists, educators, environmental educators, and school administrators … people in disciplines outside of design, are really interested in how designers are talking about designing for behavior change.

Faculty (F) is a strong proponent of collaboration and group work and often incorporates this in her courses. She has found:

> "Intermixing the students and the disciplines is really a fascinating observation … you see them start to break down their siloes and realize that they can think about design on a broader level even though they may not have the technical skills".

Interviewee (G) has noticed the same from her courses that bring together graphic and interior designers. As students from different disciplines work together on a common project she found "it takes a little bit of

the burden off of that designer to concentrate on what they're good at while being introduced to something they wouldn't have been introduced to otherwise."

Collaboration however, does not come without its challenges, something most interviewees were quick to point out. Faculty member (D) has found there is a language problem that occurs when collaborating even among faculty. Interviewee (A) feared that "we might get push back from some of the social sciences realm, to say: you're designers you don't need to be thinking about behavior," similar to the way "architectural profession sort of push back against [ID] because they feel like we're bleeding into their territory."

In offering a studio to both industrial and interior design students, interviewee (F) has faced similar linguistic problems as faculty (D) has, where students from different fields are finding it hard to work together due vocabulary differences. She noticed tension between students ad "they have trouble seeing the value in what each other brings to the table because of their divided vocabulary." Students also dread collaborating because in many situations it ends up being one person carrying the entire load (D) or personalities and work styles don't match (F). To help overcome this, and encourage students to be more open to collaborating, interviewee (F) suggests being transparent about the difficulties faculty themselves face when collaborating with other faculty. Being transparent with students will help them understand and see how faculty members work through disagreements and difficulties so that they may do so as well.

On an institutional level, some faculty members may not be too willing to offer interdisciplinary courses or conduct research that requires interdisciplinary collaboration because such research is not yet recognized as "valuable" particularly when pursuing tenure and promotion (H). There have been, however, efforts to overcome the devaluing of interdisciplinary research.

The intricate complexities of collaboration particularly cross and interdisciplinary collaboration is a massive and exciting topic which is beyond the scope of this research. It is clear, however, that collaboration is a vital method through which DfSB can be offered to ID students.

5.4. Disseminating DfSB into Academia and Industry

In expanding on the third research question focused on identifying DfSB content and teaching methods appropriate for ID education, the interviews went a step further and asked interviewees to holistically contemplate how DfSB can be spread within both academia and industry. All eight interviewees proposed a number of methods to accomplish this (5.4.2) two participants however, raised a focal point: what

influence do academic institutions and industry each have on ID education? Although this is arguably a large question worthy of its own study, the following discussion lays out different arguments, challenges and opportunities raised.

5.4.1. The competing roles of industry and academia in shaping ID education

One of the advantages interviews afford is that they expose the researcher to new ideas and findings beyond those anticipated. One such finding came from the experiences shared by a couple of the interviewees who had both visited the Interior Design Education Council (IDEC) conference the year this research was carried out. At IDEC attendees were presented with an intriguing question: is education influencing industry, or is industry influencing education? This question was spurred on by a keynote speaker who faculty (A) felt "stepped on the most toes for a good reason," asked the audience: "at what point did universities start following practice, why is that happening? Was that a good shift or was it a defective shift?" The speaker reminded faculty that "the idea behind universities initially (...) was to instigate change. Now that's not happening much anymore." Interviewee (A) agreed with the IDEC speaker and said she feels practice is determining what ID programs teach and used the expression "the tail is wagging the dog." She wished universities and students could lead research on DfSB and feed it back to industry. Having practiced for a while before going into academia, faculty (A) feels:

> "The practicing design community is in need of some inspiration – [which] can come from sound research [and] from people who are very passionate about it. I think the practice of design has led to some stagnation".

Having been part of IDEC as well and been presented with the same question of who is leading ID, education or practice, interviewee (F) was not as sure as faculty member (A) but did feel that "it seems like CIDA[58] is responding to what the industry is demanding, or that's the vocabulary that we tend to use."

Interviewee (G) believed academia has a greater opportunity at influencing industry, she stated:

> "By putting students out there that have more curious minds and have a better set of skills than the generation before them and the generation before them" after spending some time in industry "you've still got the engrained curiosity and that engrained idea that things can be amazing and when you're put in a position where you can make that decision between making an amazing decision and a ok decision hopefully you're going to make the amazing decision".

When other faculty members were asked to react to this topic they, for the most part, believed influence should be carried in a delicately balanced manner where both industry and academia respond to one another creating well-rounded students and professionals. On a basic level though this finding suggests if

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[58] Council for Interior Design Accreditation

DfSB is to be incorporated in ID education; both academic institutions as well as industry need to be introduced to the area and its benefits. Some methods for accomplishing this are presented next.

5.4.2. Methods for disseminating DfSB in ID

Interviewees were asked to weigh in on this challenge and present methods through which DfSB can be disseminated into both areas. All eight interviewees have worked or continue to work in industry therefore they can arguably provide insights into ways for disseminating DfSB into both academia and practice. Both CIDA and LEED were viewed as major facilitators for disseminating DfSB into ID education and industry by seven of the eight interviewees. For educational institutions, faculty believed if CIDA required DfSB it would spread across programs and gain traction because everyone "would have to do it" (E). Both interviewees (A and F) felt DfSB could fit into (CIDA)'s 2017 vision as this version appears to have a "more philosophical stand point" (A) and is moving away from being "perceived as a checklist" (A).

Even though the questionnaire revealed some faculty members thought there were barriers to CIDA requiring DfSB could form a potential barrier due to CIDA already requiring too many topics as is (4.4.4), this was not the sentiment conveyed by the interviewees. Granted that interviews were conducted with a much smaller sample and are therefore not as generalizable, they do however demonstrate the varying thoughts surrounding (CIDA)'s effects on ID programs. Faculty (F) did assert there are "opportunities to be the influencers of, instead of the victims of [CIDA]." Other interviewees critiqued CIDA, their concerns however did not relate to it requiring too much content and instead faculty (C) criticized CIDA standards for being "so general" that they do not offer a "good concrete plan for how to incorporate [a topic]." Nonetheless, she did believe CIDA provides educators with "benchmarks which [are] a nice starting point." As questionnaire respondents did not irrevocably identify needing to introduce DfSB through CIDA as a barrier and with interview respondents stressing the benefits of introducing it through CIDA, this researcher is inclined towards the introduction of DfSB through CIDA. This would, however, have to be accomplished in a well-thought out process requiring further study and reflection, perhaps after DfSB is successfully integrated in a number of programs and this experience documented, analyzed and published.

Interviewees made a few suggestions for disseminating DfSB within industry, the first being through LEED. The statement faculty (F) made in regards to LEED was particularly telling, she argued if LEED isn't specifically calling DfSB then it is likely the industry isn't learning about it. This comment stressed the importance of LEED and perhaps the extent of its influence on industry. It is not possible to determine

from this comment alone just how reliant practitioners are on LEED as a source of knowledge, however, it may be argued LEED plays a significant role in shaping what practitioners hear about and value.

Interviewee (A) also reflected on the role LEED could play in spreading DfSB among practitioners and argued:

> Based on the fact that LEED actually emerged out of USGBC [U.S. Green Building Council] which emerged from a couple of business guys that really wanted to change behaviors they wanted to change the way people thought about it, I think that entity is absolutely open to something like this and can maybe help facilitate.

LEED can also contribute to spreading DfSB by introducing it through a "pilot credit." This can begin to create what faculty (F) termed a "cultural shift within the industry" that higher education can then "pull through the next realm of designers." Another suggestion was for LEED to simply post some of DfSB's resources, strategies, case studies and white papers which would be "huge" according to interviewee (E) as it conveys to the industry that DfSB is a "legit area of study and interest."

Interviewee (B) fears no document such as LEED could be perfect due it being "part of a bureaucracy" which compromises the extent to which it can be "nimble" and customized to "individual needs of a particular user or building." Faculty (A) agreed and argued "there is always a danger in terms of creating a recipe for something or a checklist." Though a passionate advocate of sustainable design, interviewee (D) had strong feelings opposing LEED and was worried it was merely a marketing strategy where the main goal becomes acquiring more points. As this research does not center around LEED or around gauging how ID faculty feel about it, the researcher did not enquire further into the topic and was content with the explanations and reasons the faculty gave. These concerns regarding LEED suggest that introducing DfSB through this system will undoubtedly have some limitations due to different people holding opposing opinions on its reliability and usefulness.

Another idea through which to spread DfSB in practice came in response to the notion that DfSB requires research on the front end of a project (2.3.3) making it important that companies allocate enough time for designers or researchers to conduct such research. Due to financial demands and time constraints, firms may be reluctant to do so. To overcome this, interviewee (H) argued "it really comes down to the bottom line" and a designer's ability to demonstrate how "the cost of that early research [can be] offset by savings later." Based on her experience, interviewee (H) admits this can be "a real hard sell because you have to sell people on the idea that they have a problem that they don't even know that they have." Both faculty members (B and G) believed building the proper rapport and trust with clients would help clients buy into the need for DfSB and the extra steps it requires. If clients know a designer is trying to collect

and analyze data "to make their project better or future projects better then most of the time" interviewee (G) believes "they're not going to have a problem with it." Similarly faculty (B) argued:

> "Really it comes down to respect for the expertise of design professionals, the more respect and trust [and] the more confidence that the public, clients and/or users have in us, the more likely they'll be to trust our suggestions that this is a worthwhile expense". (B)

Having the right client helps tremendously as interviewee (B) has found better traction:

> "Larger organizations like institutions and universities … where its institutionalized that … part of their budget is going to have to be spent on doing behavioral studies upfront or whatever extra services may need to happen in order to design this way. That can be incredibly successful".

Interviewee (F) concurred with faculty (B) that knowing what type of client is demanding such a deep level of analysis and design is important. However, when working with a client that is not already aware of this, she suggested educating clients so that they "understand the value of a deeper level of thinking."

Both faculty members (D and E) believed framing DfSB in a positive way is important when introducing clients to it. If it is not presented properly, some people may feel it comes too close to "architectural determinism[59]" which stirs a strong negative reaction from people. To avoid this, interviewee (E) often speaks of designing for behavioral change "as designing to support – not to force or determine – behavior change."

The final suggestion for disseminating DfSB into industry came from interviewee (E) who mentioned some ID faculty are researching the best methods through which to present research to practitioners given the different lifestyle, accessibility and interest they have compared to those in academia. Interviewee (E) suggested adopting findings from such research studies and using the suggested methods to successfully communicate DfSB to practitioners.

5.5. Ethics a Closer Look

The researcher felt it incumbent to address the topic of ethics further during interviews to glean further insights and reactions. Participants were asked again whether or not they saw any ethical concerns to applying DfSB in ID and whether or not they found the questionnaire results surprising.

Similar to arguments made in the comment section of the questionnaire, some interviewees also centered their discussion of ethics on the strategy used, particularly deterministic ones. There were two competing

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[59] A totalitarian approach to architecture and design that believes the design of the space dictates each and every behavior.

opinions in regards to determining occupant behavior with faculty member (H) being comfortable with helping and encouraging occupants but not forcing them to "do something against their will," because in her opinion, "it's tough to say that our clients don't have minds of their own and can't figure out how they want to respond to our spaces." Interviewee (A) on the other hand did not advocate the use of determinism but had a different opinion regarding the client's role. She shared a recent discussion where she asked students "do you think the client always knows what she or he needs?" her statement sparked a dialogue with faculty (A) arguing clients or users "don't know what they don't have, they don't know what they haven't experienced." Additionally, because every design is a behavior manipulation, interviewee (A) believes as long as the designer has the "users' welfare and betterment in mind" then the designer is being ethical.

Interviewee (B) believes interior designers are hired for their expertise and if they fulfill the client's requirements then they are "free to also bring other benefits to the table."

When interviewees were informed of the questionnaire results and the general dismissal of ethical concerns, three faculty members offered their own explanations. Faculty (A) was not surprised by this finding and thought it was quite logical due to the characteristics of the questionnaire's participants. She argued designers that are going to "take the time to be part of a questionnaire, to be part of the betterment of the education … already have the good [of the client] in mind and it probably would not have occurred to them that there would have been an ethical breech because among the pool of them there probably wouldn't have been." Interviewee (F) found it surprising and wondered if the question was misunderstood while faculty (E) thought the question may have required a more "nuanced" understanding of design, behavior and sustainability than some of the questionnaire respondents had. She noted:

> It may require a more nuanced understanding than what some of your survey respondents had. I can see how it could be confusing (…) the reason I grip onto it is because I've thought about it before.

It is apparent that ID faculty members overall are comfortable using design to encourage sustainable behavior and do not anticipate there being hindering ethical breeches to doing so as long as the occupants' welfare is intact and strategies are not too forceful. ID faculty also felt justified in encouraging sustainable behaviors because design encourages all types of behaviors and therefore encouraging a positive behavior like sustainability should be no different if not even more justified. Further discussion on ethics will follow in 7.1.3.

6. Summary of Findings

In response to research demonstrating buildings are not achieving their sustainability goals due to a number of factors including unforeseen occupant behavior (2.1.2), this research investigated the possibility of integrating DfSB into ID programs as a means to better understand and design for sustainable human behavior. The researcher examined this main question through a series of sub-questions with the first questioning the state of DfSB in ID programs, the second uncovering potential barriers to integrating DfSB, the third, collating content about what DfSB education within ID should encompass along with methods of teaching it and the final questioned the ethics of changing behavior through ID.

As both sustainable design and human behavior, are part of ID education, it was assumed some aspects of DfSB may already exist within ID programs. Therefore through three phases of investigation[60], this research began by canvasing the current ID educational scene for evidence of DfSB concepts and components currently taught. When such evidence was found, a deeper investigation into the content being offered and the methods used to teach DfSB was carried out. The research investigated DfSB's state through gathering information from ID faculty members and ID programs' online literature.

Questionnaire analysis demonstrated that 33% of faculty members' believed they were *fairly* familiar with DfSB (which was the highest percentage in response to the question) followed closely by those who believed they were *moderately* familiar (28%). However when their definitions and descriptions of DfSB were analyzed against DfSB's scholarly definition the largest percentage of definitions did not present familiarity with DfSB (40%) followed closely by those demonstrating a *moderate* familiarity (39%) and only 10% could be labeled as *fairly* familiar. Interview respondents attributed limited familiarity with DfSB to a number of reasons including the terminology DfSB not existing in ID literature, questionnaire participants not having the necessary background in social sciences, and the nature of academia itself which encourages the prosperity of siloed research interests and work. There was a general agreement with all of DfSB's tenets as put forth by this researcher. Faculty members' positive attitudes were an encouraging finding indicating they are likely to accept DfSB integration into ID as they agree with its essential ideas. This was further supported by respondents' overwhelming agreement that DfSB is important to ID, that they're interest in teaching it, and their belief that other ID educators believe that as well. This final point indicates faculty members would probably have a supportive environment if they choose to teach DfSB.

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[60] See methodology for a detailed explanation of questionnaire, survey and interview phases (3).

Online literature published by top ID programs was examined next to identify the presence of DfSB within them in an effort to locate courses from which DfSB can be introduced. DfSB was not specifically mentioned in any of the programs nor was the concept of intentionally changing behavior through the use of design. Although there were courses that covered sustainable design and others on behavior there was nothing to suggest the two subjects were linked or taught simultaneously. Even in the courses that did examine the effects of the built environment on behavior there was no mention of using the environment's influence to change behaviors. As both sustainability and behavior courses do exist, this could mean an easier transition into DfSB than if these courses did not exist at all. Additionally, faculty members that teach these courses may be inclined to learn more about DfSB and implement it seeing how it relates to their areas of interest and teaching.

When questionnaire respondents were asked whether their programs included DfSB, the majority indicated that it did in either an explicit or implicit form. Upon further scrutiny, however, it was found that there were inconsistencies among faculty within the same program who took the questionnaire, with one respondent indicating DfSB is included and another claiming it isn't for the same program. A second survey of ID programs was conducted, specifically of those programs whose faculty members indicated that they explicitly teach DfSB in their program. Again, no specific mention of DfSB or encouraging sustainable behaviors through the use of design was found in any of the online material. When interviewees were asked to explain the general lack of DfSB mention in online material, they offered a number of explanations including faculty members not knowing enough about the field to include it in the material, the fact that DfSB might exist within courses under the larger banner of sustainable design and finally the nature of writing material such as course descriptions which requiring faculty members to keep the language general enough to allow teaching flexibility. Questionnaire respondents also believed some aspects of DfSB are taught within sustainable design despite the lack of terminology.

In terms of DfSB content, questionnaire respondents indicated they cover the major theoretical fields essential to DfSB. Environmental psychology was offered the most, social psychology, on the other hand, was offered the least. The limited focus on social psychology presents a challenge for DfSB as literature from this area is central to DfSB. This finding echoes remarks made by interviewees communicating that students lacked the proper foundation in social sciences essential for DfSB education. Questionnaire respondents also believed they include DfSB components in their course mostly, proposing new strategies for behavior change and employing a user-centered design process. Interviews suggest however, that user-centered design is not practiced in ID the way it in DfSB particularly in regards to the clients' level of involvement in the design process. Questionnaire responses showed theoretical fields related to DfSB along with its components are mainly offered through studio courses and as part of broader lectures.

Introducing DfSB through studios also favored by interviewees who felt it provides more room for investigation and questioning.

The second research question focused on identifying barriers to integrating DfSB and was investigated through the questionnaire and follow-up interviews. Findings from both research methods demonstrated faculty members' lack of sufficient knowledge and awareness are the most dominant barriers to DfSB's integration into ID. Interviewees believed a full adoption of DfSB is missing and that only a very small number of faculty members champion such an approach. Nonetheless, some interviewees were optimistic as they believed if faculty learn about DfSB they are likely to teach it. Interviews presented two other barriers that related to ID programs, namely; ID programs' reliance on an applied teaching method with a limited focus on theories and second, programs not providing students with an appropriate foundation in social science courses crucial for DfSB. These additional findings suggest ID programs hoping to integrate DfSB may need to rely more on introducing students to DfSB through applied studio projects along with finding ways to overcome the limited coverage of of social science theories. Through interviews and the questionnaire, participating faculty members were asked to suggest ways through which to overcome the main barrier identified by this research, namely; faculty members' shortage of DfSB knowledge and awareness. All conventional methods such as publications, conference presentations and educational credits were suggested. Different forms of collaborations and charrettes were also proposed as a fun way through which to introduce DfSB and at times engage students and other faculty. Having a strong advocate for DfSB within a program was also suggested as a means of spreading awareness and ensuring the success of integrating DfSB into ID.

Faculty members' suggestions were collected in response to the third research question, namely what should a DfSB education in ID encompass and how can it be taught? Questionnaire answers presented a number of suggestions the most prominent were explicitly introducing and using the term DfSB in ID education and increasing faculty's knowledge and awareness of the field. Interviewees thought DfSB strategies are applicable in ID with some favoring the deterministic and others leaning towards the informative. Interview participants also proposed enhancing students' observational skills which would allow them to identify unsustainable behaviors occurring in a space and focus their designs on changing them. Some interviewees suggested DfSB could first be introduced as an elective for interested students but would eventually need to be integrated in different courses at different points to overcome students' tendency not to carry information from one course to another. Due to DfSB's interdisciplinary nature and its reliance on fields beyond design, including but not limited to the social sciences, collaboration, with both students and other faculty was perceived as a highly useful method for bringing in expertise from

various fields. The challenges of collaboration along with some suggestions for overcoming them were also discussed during interviews.

The final question raised by the researcher was that of ethics and its place within the overall discussion on applying DfSB in ID. DfSB scholars consider the ethical implications of changing behavior to be an important part of a DfSB discussion. ID faculty expressed a range of opinions. Most prominent was the idea that design encourages all types of behaviors all the time and that sustainable behaviors shouldn't be any different, on the contrary, as these are positive behaviors, some ID faculty felt justified in encouraging them. There was an important caveat, however, that occupants should not be harmed by DfSB interventions nor should the interventions be too deterministic they would create a rebound effect[61].

The research has established the presence of positive attitudes towards DfSB and a willingness to teach it amongst ID faculty, along with identifying courses that either already contain aspects of DfSB or could easily accommodate it. It also pinpointed important barriers to integrating DfSB and collated suggestions for overcoming them. In the following section a discussion of these findings will be presented.

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[61] A rebound effect occurs when occupants use "work-arounds" to resist the behavior they are being forced to do by design interventions, resulting at times in greater environmental harm (Lilley & Lofthouse, 2010b, p. 59)

7. Discussion

In this section, findings from all phases of this research are synthesized to form a response to the four research questions posed by the researcher. The first section (7.1.1) addresses questions one and three, namely; identifying the current state of DfSB within ID education and simultaneously indicating how DfSB content can be introduced, given this current state, and using which methods. The second section (7.1.2) focuses on the second question that relates to barriers for integrating DfSB and suggestions for overcoming them. While the final section (7.1.3) addresses the fourth question pertaining to ethics and its place within a DfSB education in ID.

7.1.1. Working With the Educational Terrain

This research found there to be three overarching challenges facing ID programs as a whole. Two of these challenges are also cited in both ID and industrial design literature. The first challenge is a struggle with curriculum length and depth (5.2.3) as presented in the literature by both Crane (2008) and Gürel (2010). The second is students' tendency to compartmentalize knowledge; not carrying it through from one course to the next. This challenge is not only identified by this research, but also in literature in ID (Crane, 2008) and industrial design (Watkins, 2013). Finally, a limited exposure to behavioral and social theories that explore the relationship between occupants and their environment could create a challenge for DfSB.

For programs that find themselves in such a situation DfSB needn't be an extra topic that overwhelms a strained curriculum; rather it may be introduced as a unifying worldview that strings together several courses. Within any topic, be it space planning, sustainable building systems, human behavior, or material, finishes and equipment selection, a DfSB perspective can be introduced providing students with a justification for their decisions and designs. DfSB offering justifications for design decisions was an idea expressed through interviews in this study (5.1). Faculty also suggested a deeper and more targeted exploration of DfSB can take place in design studios with some projects dedicated primarily to DfSB and others addressing it along with other project goals. Studio teaching was also a favored method for introducing new areas of sustainability by industrial design faculty (Watkins, 2013).

Integrating DfSB into various courses serves another purpose beyond reducing strain on a curriculum; it also helps students overcome their tendency to compartmentalize their sustainability learning. One interviewee even suggested running theoretical seminars alongside studio projects to help clarify the link between the two and arguably smooth the process of synthesizing information. The benefit of employing an integrated approach to sustainable design education has been identified by faculty members

surveyed and interviewed by both Crane (2008) and Watkins (2013). As for overcoming the lack of sufficient social and behavioral science exposure, this may be accomplished through collaborating with experts from these respective fields who can introduce students to necessary theories (5.3.2). The importance of reaching out beyond ID and learning from numerous fields was also argued by Sorrento (2012) in the integrative design process she proposed adopting.

When introducing students to new theories it is important to consider that some faculty noted ID students find it hard to latch on to abstract theories and prefer instead to work on applied projects (5.2.4). To address this it may be best to learn from Lilley's experience and illustrate theories directly through sustainable interiors, products and designs. She found this increased her industrial design students' understanding and engagement with DfSB (2.5).

Illustrating DfSB theories through products does not present a challenge as numerous compilations exist in the form of DfSB tools (2.3.4) along with online material[62]. However a collection of interiors that illustrate the application of DfSB theories is currently lacking (a finding presented in both questionnaire and interview analysis 4.4.4). This could present ID faculty members with a challenge similar to that faced by Lilley, namely; using examples from different fields exposed students to field-specific terminologies that were foreign to them (2.5). Some ID interviewees have also shared their students' struggle when collaborating with students from other fields due to linguistic differences (5.3.2). Collecting and sharing DfSB examples within ID is therefore an important endeavor and a crucial follow-up step to this research. This should not; however, delay ID faculty members from introducing DfSB into their courses as all the examples available in industrial design can be enlightening to interior designers specifying products within their spaces. Additionally, DfSB presents students with its own set of terminologies[63] which, this researcher believes, can give students from different backgrounds a unifying language through which to communicate past their differences.

Beyond providing potentially unifying terminologies, DfSB content presents strategies for changing behavior that range in their forcefulness from those that inform to those that determine. Although interviewees found them to be applicable in ID, their discussion (5.3.1) also indicated further in-depth and contextual consideration is necessary to clarify when to use which strategy and how. Depending on space, behavior and client, interior designers must decide whether deterministic behaviors are more appropriate for ensuring long-term benefit or if they are likely to cause a rebound effect. This may be explored by students in their studio projects and during critical discussions in Human Behavior courses. Applicability

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[62] Such as Lilley's www.design-behaviour.co.uk website (2.5).

[63] DfSB includes terminologies from all the various theoretical fields it encompasses (for a list of the main fields see 2.3.1).

of strategies can also be analyzed through funded research endeavors whether confined to academic institutions or beyond them to include collaboration with industry. Nonetheless, introducing these strategies to ID helps overcome the gap in knowledge identified by this researcher, namely; strategies used in ID to influence behavior are limited to informing and educating (2.6).

DfSB also presents a user-centered design process that captures and incorporates user input as a guide for design decisions. Interviewees did argue the benefits of engaging different stakeholders in the design process as did Sorrento (2012) in the literature, however it appears implementing this in ID education is limited to the theoretical (5.1). Based on the interviews, endeavors that fully integrate real clients and stakeholders in every phase of the design process and its iterations are encouraged but not practiced in ID programs. However, as this finding was deduced from interviews and not the questionnaire, it cannot be generalized to all ID programs. Determining if, and how, a comprehensive user-centered design process exists within ID is a crucial topic for the advancement of DfSB within ID and arguably the industry as a whole. However, this is beyond the scope of this research which was content in finding faculty believe they do discuss involving stakeholders in their courses as established in the questionnaire (4.3.2.2.2) and interviews (5.1). This finding was sufficient at this point because it establishes a baseline from which to then pursue a vision of user-centered design that is closer to that applied in DfSB exists.

Along with working with the challenges outlined above to weaving in DfSB content through appropriate teaching methods, it is also important to identify the influential forces shaping the educational terrain. Some interviewees believe academic institutions are allowing industry to dictate what they teach, while other faculty members believe both industry and academia are equally influencing curricula (5.4.1). Those attempting to integrate DfSB into a particular program may benefit from determining the direction of influence occurring, meaning whether their program is adamant about leading educational trends or if it prefers to focus on meeting the demands of industry. Knowing this can help faculty members build an argument in support of integrating DfSB within their particular ID program. For institutions that value academic pursuits and research advancements DfSB scholars can speak of its vast research potential and numerus studio applications. As for programs working to meet industry needs, advocates of DfSB can stress the field's marketability to design firms that are increasingly dedicating hours, and in some cases departments, to sustainable design research within which DfSB resides. DfSB advocates can also argue employing DfSB strategies in projects can produce long term savings and help overcome the performance gap in buildings[64] (2.1.2).

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[64] Performance gap: buildings designed for sustainability not performing as predicted. This was discussed in 1.1 and 2.1.2

In order for DfSB to flourish, both academic institutions and industry need to embrace it and dedicate research grants to it. There are countless questions to study and ideas to test and they all require dedicated researchers, existing projects and repeated access for longitudinal studies and analysis. Each party can bring incalculable benefits and necessary perspectives to a research study and consequently to projects. The major selling point for any client is the ability to save money as identified by interviewees (5.4.1). If DfSB can demonstrate the monetary savings it is capable of achieving then far more clients will be willing to embrace it. However savings cannot be demonstrated if the studies and experiments that prove it do not take place and these experiments cannot take place without industry and institutional collaboration. Faculty members did not believe there were limited opportunities to collaborate with industry on DfSB projects (4.4.3) which is a promising indication. Future work should focus on understanding and refining collaboration between ID industry and academia particularly as it relates to DfSB research.

For faculty who might not fully embrace DfSB for reasons presented by interviewees (5.2.1), mandating it through CIDA and LEED would force faculty members to teach it regardless of their individual belief. The quality of teaching and learning may arguably differ based on a faculty's conviction, but at least requiring DfSB ensures students are exposed to it and can explore it further on their own. Interviewees believed requiring DfSB through CIDA and LEED would be great for the field's dissemination. However in reflecting on both the praise and criticism laid at CIDA, namely; that it is too general and that its newer version includes lofty and theoretical terms, this researcher fears this may pose a challenge for faculty members who are not too familiar with DfSB. This concern is due to interviews showing faculty are having trouble applying sustainable design theories in courses (5.2.2) and with CIDA adopting a more theoretical language it is important that any instructions or guides to incorporating DfSB are clear about how theories can be applied and taught. Whether these guides are through CIDA or another document they must be specific enough that faculty members know how to apply them but general enough to allow faculty to depart from the guidelines and take DfSB to new directions.

The following section discusses some more challenges that relate to faculty members and ways of overcoming them.

7.1.2. Working with ID Faculty

Faculty members' varying levels of familiarity and knowledge of DfSB was identified as a major barrier to integrating DfSB (4.4.1 and 5.2.2). This echoes findings presented in literature published on advancing

sustainable design education in ID (Crane & Waxman, 2009; Gürel, 2010; Lee, 2014). It is possible however to get past the lack of knowledge considering the majority of faculty members have displayed positive reactions to DfSB and a willingness to teach it (4.3.1.2 and 4.3.1.3). Naturally, some respondents were more enthusiastic about DfSB than others were depending on each individual's interests and commitment to sustainable design. Conventional methods for increasing faculty members' exposure and knowledge of DfSB were recommended by respondents and in the literature (Gürel, 2010). These included conferences, publications, certifications and workshops. Some of the questionnaire respondents did however indicate a concern regarding fees that would be associated with further certifications and dedicated conferences (4.4.6), a concern ID faculty members expressed to Crane (2008) as well. Including DfSB within established conferences like IDEC and EDRA would expose a larger audience to the topic without adding costs of attending an additional conference. DfSB can be included in conferences in a mixture of ways including research papers, presentations, lightning sessions, panel discussions and charrettes. Charrettes would help faculty members learn about DfSB and explore applying it. They could then take this applied learning experience, adjust it and introduce it to their studio courses as discussed above (7.1.1).

Programs interested in DfSB can offer faculty members the knowledge with little to no cost by hosting both physically and remotely a DfSB scholar (or scholars) who can lead an introductory workshop. Workshops can include a mixture of talks and mini charrettes and involve faculty members from various backgrounds. Upon receiving this introduction into DfSB each program can initiates its own agenda for the exploration and advancement of the field. This can include both large and small scale initiative like an annual DfSB event that brings together students and faculty from all design and architecture backgrounds (as suggested by in an interview 5.3.2) and reaches out to participants in both the hard and social sciences. Collaborating with faculty members in other fields was identified through interviewees as a promising way for faculty to learn about topics that are relevant to DfSB but are beyond ID. According to statistics from Design Intelligence an increasing number of schools are moving in the direction of placing "more emphasis on interdisciplinary collaboration and integrated practices" (2014, p. 78) which indicates encouraging faculty from ID to work with those in other fields for the benefit of DfSB is in line with the direction ID education is headed.

Despite promising statistics from Design Intelligence, some faculty indicated there still may be problems on the ground when it comes to acquiring funding for interdisciplinary research (5.3.2). This assumedly differs from program to program and may pose a challenge for some faculty members. As DfSB research grows in institutions that support interdisciplinary research it may be argued other institutions may be more inclined to follow suit with time. Advancing DfSB research within ID can also help overcome

another barrier identified by this researcher, namely; the lack of resources in DfSB as it pertains to ID. Research in ID would start to accumulate literature and statistical data to be used by students, other researchers and industry. Increasing research produces publications which in turn spreads DfSB knowledge among faculty, increasing their familiarity and overcoming the main barrier to integrating it further into ID.

7.1.3. Revisiting Ethics

For the most part faculty members' comments drew parallels with Fogg's model for assessing the ethicality of an intervention (2.4). Comments demonstrated respondents found *intentions* were important, indicating as long as no harm was intended and the behavior being encouraged is a positive one then a design would arguably be ethical. Respondents were also aware *methods* are an integral component to ethical design as was demonstrated in the discussions and comments surrounding deterministic strategies. *Outcomes* of design interventions were not discussed by ID faculty members but they were not explicitly asked to comment on outcomes and so it may not be assumed that outcomes of a design intervention would not be part of their ethical rationale. Additionally, Fogg's model exists within persuasive design literature and it would therefore be unreasonable to expect ID faculty to bring it up.

It is arguably essential to conduct further research on the general question of ethics within ID education and practice before drawing conclusions or making suggestions on ethics as it particularly relates to DfSB in ID. The fact that about a third of respondents gave a mixture of comments that could not be readily categorized (8.10) suggests there is a wide range of opinions regarding the matter and plenty of intricacies to explore. The researcher agrees with the interviewee who suggested the question may have required a more nuanced understanding of design, behavior and sustainability from respondents, and also agrees with faculty who suggested the question in the questionnaire was probably difficult to answer (5.5). In the future when ethics is explored it would arguably be difficult to do so in a questionnaire. When interviews are used ethics should either be the focus of the questions or at least the focus of the majority of them as this topic requires sufficient time for critical thinking and reflection. Future studies can compare teaching ethics within ID to teaching it within industrial design as presented by Lilley (see literature 2.5) to propose a process through which to successfully tackle the topic within ID education particularly pertaining to DfSB.

Drawing final conclusions in regards to the ethics of DfSB within ID was not the researcher's intention as that would have been too ambitious within the constraints of this study that examined a number of other

major topics. Nonetheless, the general awareness faculty demonstrated of ethical lines that need to be drawn is a positive finding from which to begin further studies that delve deeper into identifying these lines and the situations that call for them. A second step would be to compare ethical lines drawn by ID faculty and those drawn by DfSB scholars. Furthermore, it is clear an ethical discourse exists within ID program as 60% of questionnaire respondents who indicated they teach DfSB also indicated they discuss the ethics of changing behavior through design interventions in their courses. This research did not delve deeper into how this topic is examined which arguably could be an area for future research to tackle.

7.2. Recommendations

Every program has its own unique philosophy and presents its own sets of challenges and opportunities. Faculty members wishing to integrate DfSB into their program should clearly identify their programs' strengths and challenges to capitalize on the first and overcome the latter. The discussion above presented several points to consider including identifying existing courses that can include DfSB, gauging colleagues' knowledge level, ascertaining students' learning preferences and framing the argument for integrating DfSB in manner that matches the direction and goals of the program.

Below are some recommendations deduced from this research's findings. The list is by no means comprehensive and is meant to help generate more thoughts and ideas. It is inspired mainly from findings on integrating DfSB into existing courses with the understanding students lean towards practical methods of teaching and require a stronger foundation in social sciences. Interested faculty members can:

- Capitalize on relevant courses that already exist in the ID program including human behavior, critical design thinking and sustainable building systems. Introduce relevant DfSB content and questions as appropriate, for example in a human behavior course students may be asked to study characteristics of a particular user group and propose tailored designs that would encourage that unique group to engage in environmentally conscious behaviors. In a critical design thinking course an instructor can present an ethically challenging situation and facilitate a discussion on how such a scenario can be tackled. And finally a sustainable building systems class could collaborate with engineers and programmers to propose a design intervention that steers behaviors through technology and simultaneously collects data on initial and changed behavior patterns to create a feedback loop.
- Capitalize on any humanities and/or social science requirements beyond the ID program by reaching out to the faculty offering them and ensuring the content relates to ID and particularly

DfSB. Additionally, plan small projects in ID courses that correspond to theories introduced through the humanities and social sciences.

- Along with inviting experts to speak in classes, ensure they engage students in a practical project to increase the likelihood of students grasping the theories by immediately seeing their applicability. Contributing to a project may also cause experts to reflect on the information they provided making it a learning experience for them as well.

- Collate examples of DfSB in ID from personal practice experience and literature. Assign this task to students in relevant courses and encourage them to start an open online database that can be updated after every semester.

- Bring back the art of observation. Introduce students to observation as a research method and require or encourage students to spend a set amount of hours observing a space, tracking behaviors, documenting and reflecting on what they've observed.

- Build on observation exercises and initiate small achievable projects where students select an unsustainable behavior they've observed, manipulate the space, observe and document the changes that occur and share their findings with other students.

- Organize quick charrettes where students are presented with a space, an unsustainable behavior, and an occupant profile and are tasked to propose as many creative design strategies for changing the unsustainable behavior as possible. Discuss and reflect on the strategies proposed.

- Turn students into occupants. If real projects and occupants can't be accessed for a particular studio project, engage student volunteers from a different year to play the role of occupants. Studio students can therefore practice applying a user-centered design process that engages occupants in every phase of the design process while student volunteers are also exposed to this process and can apply their experience into their own projects or workplace upon graduating.

- Reach out to DfSB scholars in industrial design. DfSB scholars can provide lectures, share experiences, advise on challenges and even co-teach a class. Depending on the logistics, an ID faculty can co-teach a course with a DfSB scholar which engages students from different design majors.

7.3. Future Work

Having formed an understanding of DfSB's state within ID and ideas of further integrating it into education, future endeavors would focus on selecting an ID program to practically test the integrating of DfSB into. This can provide a real world understanding of the logistics and obstacles. Publications on the

process of integrating DfSB to a select program can also start to address one of the barriers identified by this research, namely; lack of resources for ID faculty to draw on. Another direction would be to repeat this study within the context of industry so that a clearer understanding can be drawn of both forces influencing ID in general and ID education in particular. This could lead to further studies including one that analyzes current collaboration efforts occurring between ID educational institutions and ID industry in an effort to increase such efforts and introduce DfSB as an area for collaborative studies.

A number of research questions were indicated throughout this discussion which included:

- How can ID educators capitalize on the advantages of cross-disciplinary collaboration and overcome its challenges?
- Does an ID education typically include user-centered design? What form does that take? How involved are users in the process?
- How do interior designers view their clients and space users, and how does that effect discussions on the ethical implications of design?
- How do interior designers define ethical design? How is this definition reflected in DfSB's ethical considerations?

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8. Appendices

8.1. Appendix - 1

Overcoming disadvantages of questionnaires

Disadvantages of Questionnaires taken from (Robson 2011) and (Gillham, 2000)	How the questionnaire design addressed the possible disadvantages
"problems of data quality (completeness and accuracy)"	Two rounds of reminder emails were sent to the sample that did not complete the questionnaire. The emails were a week apart.
"Typically have a low response rate" (Robson, 2011, p. 240)	Questionnaire was sent to educators in interior design and the recruitment email subject line clarified the survey was regarding behavior, sustainability and design to entice interested faculty. Individualized emails using faculty names were sent which increased the possibility of responding (Watkins, 2013). Additionally, in the recruitment email, the researcher motivated faculty by offering to share results with those who are interested.
"They need to be relatively short" (Robson, 2011, p. 248)	Questions went through several drafts and rewrites to insure the questions are as short and as direct as possible.
"self-explanatory" (Robson, 2011, p. 248)	Through two rounds of pilot studies questions that were unclear were identified and rewritten. Additionally, faculty were provided with a definition and explanation of DfSB in the questionnaire to insure there was a baseline of shared knowledge and that the meaning of DfSB was unanimously understood.
"misunderstandings of, the survey questions may not be detected" (Robson, 2011, p. 241)	Researcher sat with faculty at VT as they took the survey and noted any ambiguous questions. Also the recruitment email provided respondents with three contacts to email if they had any questions or concerns.
"assumes respondents have answers available in an organized fashion"	The online questionnaire allowed respondents to save their progress and return to complete answers. This would allow them to find any answers they were missing.
"no control over the order in which questions are answered" (Robson, 2011, p. 248)	Due to the nature of online questionnaires, questions are presented to respondents in a specific order. However, the researcher decided to provide respondents with the opportunity to move back in a questionnaire, this was thought to increase the validity of answers because of a respondent was unsure how to answer a question or if they misunderstood at and realized they had a few questions later they would have the opportunity to rectify this. There was also an order programed into questionnaire where the questionnaire required a respondent to answer a question before they are allowed to continue, this was crucial for one the following questions were tailored based on the answers provided on that one.
"questionnaire wording can have a major effect on answers"	Researcher sat with faculty at VT as they took the questionnaire and noted any ambiguous or leading questions which were then rewritten. Comment sections were also added to allow faculty to explain their answers.
"respondents won't necessarily report their beliefs, attitudes, etc. accurately" (Robson, 2011, p. 240)	By using a mixture of closed and open ended questions, the most important topics were asked in both formats to allow comparison and analysis (e.g. the question of DfSB familiarity). Respondents also provided the names of their institutions which allowed checking responses' accuracy.

8.2. Appendix - 2

Pdf Prints from two websites used to help students locate institutes that offer programs and majors they are interested used to deduce the number of ID programs available in the U.S. Colleges.startclass.com – showed 247 programs and myplan.com – 243 results

MyPlan.com

| Careers | Assessment | Colleges | **Majors** | Account |

| Majors Database | What Can I Do With a Major In ... | Top Ten Lists | Majors Community | Online Resources | More ... |

My Account

Interior Design

Add to Portfolio

Description | Colleges That Offer This Degree | **What Careers Are Related?** | Community

Majors / Interior Design

Colleges That Offer This Degree

Email to a Friend   Printable View

All A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

☑ Certificates (C)   ☑ Associate's (A)   ☑ Bachelor's (B)   ☑ Master's (M)
☑ Graduate-Level Certificate (GC)   ☑ Doctorate (D)   ☑ First-Professional (FP)   Go!

College	State	Degrees
Abilene Christian University	TX	B
Academy of Art College	CA	A, B, M
Adrian College	MI	B
AI Miami International University of Art and Design	FL	B, M
Alexandria Technical College	MN	C, A
American Intercontinental University	GA	B
American Intercontinental University	FL	B
American Intercontinental University	CA	B
American River College	CA	C, A
Anderson College	SC	B
Anne Arundel Community College	MD	C
Antelope Valley College	CA	C, A
Appalachian State University	NC	B
Arcadia University	PA	B
Art Institute of Atlanta	GA	C, B
Art Institute of California, Los Angeles	CA	B
Art Institute of California, San Diego	CA	B
Art Institute of Colorado	CO	B
Art Institute of Colorado	AZ	B
Art Institute of Dallas	TX	B

Colleges 1-20 of 243   First | Previous | Next | Last

Source: MyPlan.com, L.L.C. 2014; National Center for Education Statistics, 2009

8.3. Appendix – 3

Survey on the Integration of Design for Sustainable Behavior in Interior Design Education

Background Recent years have witnessed increased interest in how designers and design solutions can positively influence human behavior and bring about more sustainable practices. This survey is concerned with understanding the degree to which students in US interior design programs are exposed to this question. The objective of this survey is to map out the current state of "design for sustainable behavior" in interior design and to identify challenges and opportunities for further incorporating it in education.

Survey The survey consists of 12 questions followed by a section on demographic information.

Participation Participation in this research is completely voluntary. You may withdraw at any time. If you desire to withdraw, please close your internet browser.

Confidentiality The identity of participants will be kept confidential and the results will be reported in a manner such that individual participants or their institutions cannot be inferred. Questionnaires will accessed only by the research team.

For Questions, please contact us:

Danya Hakky, (PhD candidate)   email: danya@vt.edu

Dr. Lisa Tucker, (Committee co-chair)   email: ltucker@vt.edu phone: 540.231.9494

Dr. Patrick Miller, (Committee co-chair) email: pmiller@vt.edu phone: 540.231.0611

Should you have any questions or concerns about the study's conduct or your rights as a research subject, or need to report a research-related injury or event, you may contact the VT IRB Chair, Dr. David M. Moore at moored@vt.edu or (540) 231-4991.   This questionnaire has been approved by the Virginia Tech Institutional Review Board for Research Involving Human Subjects (IRB).

IRB review number 15-904

Please allow pop-ups from this site to access important information.

I have read and understood the above and desire to participate in this study.

❍ Yes (1)
❍ No (2)
If No Is Selected, Then Skip To End of Survey

I am a:

❍ Student (1)
❍ Faculty member (2)
❍ Both (3)

If Student Is Selected, Then Skip To Your opinion and feedback is very imp...

Q1 To what extent do you agree with the following statements?

		Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
	Sustainable Design					
1	Designing sustainable interiors reduces the building industry's negative impacts on the environment.	❍	❍	❍	❍	❍
2	The benefits of sustainable design on the environment have been over emphasized.	❍	❍	❍	❍	❍
3	It is an interior designer's professional responsibility to create sustainable interiors.	❍	❍	❍	❍	❍
	Impact of behavior on building performance					
4	Occupant behaviors impact sustainability in buildings.	❍	❍	❍	❍	❍
5	It is important to reduce any adverse impact of behavior on the environment when possible.	❍	❍	❍	❍	❍
6	It is the occupant's responsibility, not the designer, to consider the impacts of their behaviors on the environment.	❍	❍	❍	❍	❍
	Relationship between design and behavior					
7	Design, by its very nature, encourages certain behaviors over others to achieve the designer's intent.	❍	❍	❍	❍	❍
8	Trying to influence behavior is beyond the scope of interior design.	❍	❍	❍	❍	❍
9	Occupant behavior is too varied and unpredictable for it to be included in design decisions.	❍	❍	❍	❍	❍
	Encouraging sustainable behavior					
10	Encouraging occupants to engage in more sustainable behaviors (like using less energy and recycling regularly) can significantly reduce the negative impact of buildings on the environment.	❍	❍	❍	❍	❍
11	Most interior design projects already encourage sustainable behavior through their designs.	❍	❍	❍	❍	❍
12	It is interior designers' professional responsibility to encourage sustainable behaviors through their designs.	❍	❍	❍	❍	❍

Q2 How is Sustainable Design offered in your program? Please select all that apply.

- ❑ An optional elective
- ❑ Part of a required broad lecture course
- ❑ Marginally offered
- ❑ Dedicated lecture course
- ❑ Dedicated studio
- ❑ Part of a broad studio
- ❑ Integrated in multiple course, please explain: _____
- ❑ Other (please specify) _____

Q3 When discussing sustainable design, to what extent do you cover the following areas?

	Never	Rarely	Sometimes	Often	Always
Understanding people's attitudes, beliefs and reasons behind behaviors.	❍	❍	❍	❍	❍
How and why people buy and dispose of products related to interiors.	❍	❍	❍	❍	❍
Involving stakeholders (owners and occupants) in the design process.	❍	❍	❍	❍	❍
Changing attitudes and behaviors using products and strategies (click here for example).	❍	❍	❍	❍	❍
How people affect, and are affected by their environment.	❍	❍	❍	❍	❍
Sustainable building sciences and systems (example measuring building performance, passive design principles, renewable energy technology)	❍	❍	❍	❍	❍

Q4 How familiar are you with the field of Design for Sustainable Behavior?

- ❍ Not at all
- ❍ Slightly aware
- ❍ Moderately aware
- ❍ Fairly familiar
- ❍ Very knowledgeable

If Not at all Is Selected, Then Skip To What is Design for Sustainable Behavi...

Q5 How would you define or describe Design for Sustainable Behavior?

What is Design for Sustainable Behavior?

In this survey, Design for Sustainable Behavior is defined as a sub-category of sustainable design. It uses design strategies to encourage sustainable behaviors like conserving energy and recycling. These design strategies (figure below) fall into three main categories (informing, persuading, determining), each containing subcategories of their own. The strategies are organized on a continuum with designs that allow the occupants to be in control of their behavior on one end and designs that control occupants' behavior on the other (click here for more examples). Based on an understanding of occupants and reasons driving their behaviors, designers can select appropriate strategies to encourage sustainable behavior.

occupant in control   design in control

INFORMING   PERSUADING   DETERMINING

the power aware cord lights up in a range of colors to make energy consumption visible. This visual information can prompt people to unplug their equipment when not in use.

giving a staircase a prominent location and interesting design while tucking away the elevator persuades people to use the stairs and reduces energy use from elevators.

air-conditioning automatically switches off when window is opened in a room.

Q6 Does your interior design curriculum cover Design for Sustainable Behavior?

○ Yes

○ Yes but not explicitly. Explain: _____

○ No

○ I don't know

If No Is Selected, Then Skip To In regards to teaching Design for Sus...If I don't know Is Selected, Then Skip To In regards to teaching Design for Sus...

Q6a Are you personally involved in teaching Design for Sustainable Behavior?

○ Yes

○ No

If No Is Selected, Then Skip To How is Design for Sustainable Behavio...

Q6b What specific resources do you use to teach Design for Sustainable Behavior?

Q6c Which of the following topics do you include when teaching Design for Sustainable Behavior? Please select all that apply.

- ❑ Understanding and applying behavior models and theories of change.
- ❑ Designing with stakeholders.
- ❑ Surveying existing strategies for changing behavior.
- ❑ Proposing new strategies for changing behavior.
- ❑ The ethics of changing behavior through design interventions.
- ❑ Measuring outcomes of designs for changing behavior.

Q6d How is Design for Sustainable Behavior offered in your curriculum? Please choose all that apply.

- ❑ Part of a broad lecture course.
- ❑ In a dedicated lecture course.
- ❑ In a dedicated studio.
- ❑ Part of a broader studio.
- ❑ Marginally addressed.
- ❑ Integrated in multiple courses across the curriculum - please explain: _____
- ❑ other (please specify) _____

Q6e Is Design for Sustainable Behavior offered through core or elective courses?

- ❍ Core
- ❍ Elective

Q6f How satisfied are you with Design for Sustainable Behavior education in your program?

- ❍ Very Dissatisfied
- ❍ Dissatisfied
- ❍ Somewhat Satisfied
- ❍ Satisfied
- ❍ Very Satisfied

Q6e How would you improve Design for Sustainable Behavior education in your program?

Q7 In regards to teaching Design for Sustainable Behavior, to what extent do you agree with the following statements?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I believe Design for Sustainable Behavior in interior design is important to the profession.	○	○	○	○	○
As an interior design educator, I feel obligated to teach Design for Sustainable Behavior.	○	○	○	○	○
I am not interested in teaching Design for Sustainable Behavior.	○	○	○	○	○
I think many faculty members believe Design for Sustainable Behavior is important.	○	○	○	○	○
Design for Sustainable Behavior should be a required subject within interior design.	○	○	○	○	○
I am confident in my ability to teach Design for Sustainable Behavior.	○	○	○	○	○
There are enough resources available (books, articles, case studies, etc.) to teach Design for Sustainable Behavior.	○	○	○	○	○

Q8 To what extent can the following be considered barriers to incorporating Design for Sustainable Behavior in your curriculum.

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree	Don't know
Not enough faculty members are aware of Design for Sustainable Behavior.	○	○	○	○	○	○
Interior design faculty lack the necessary knowledge to teach Design for Sustainable Behavior.	○	○	○	○	○	○
Interior design students are not interested in Design for Sustainable Behavior.	○	○	○	○	○	○
Design for Sustainable Behavior is too specialized and therefore not suitable for undergraduate education.	○	○	○	○	○	○
There is not enough room in the curriculum to teach Design for Sustainable Behavior.	○	○	○	○	○	○
The ethical implications of changing people's behaviors are too complex.	○	○	○	○	○	○
Design for Sustainable Behavior is not emphasized by educational or professional standards such as CIDA, NCIDQ, or LEED.	○	○	○	○	○	○
Not enough available research on Design for Sustainable Behavior in interior design.	○	○	○	○	○	○
Teaching Design for Sustainable Behavior will not help me in my pursuit of promotions.	○	○	○	○	○	○
There are few opportunities for industry collaborations.	○	○	○	○	○	○
Applying Design for Sustainable Behavior requires access to occupants or users that is generally not available.	○	○	○	○	○	○
Interior design clients are not interested in Design for Sustainable Behavior.	○	○	○	○	○	○

Are there any other barriers to incorporating Design for Sustainable Behavior in interior design?

Q9 To what extent do you believe the following are important for an education in Design for Sustainable Behavior?

	Not at all Important	Unimportant	Neither important nor unimportant	Important	Very Important
Understanding behavior and factors that drive it.	❍	❍	❍	❍	❍
Applying theories of behavior in analysis and design stages.	❍	❍	❍	❍	❍
Designing with stakeholders (owners and occupants).	❍	❍	❍	❍	❍
Identifying existing strategies for changing behavior and proposing new ones.	❍	❍	❍	❍	❍
Discussing the ethics of changing behavior through design.	❍	❍	❍	❍	❍
Understanding sustainable building sciences and systems (e.g. measuring building performance, passive design, renewable energy technology).	❍	❍	❍	❍	❍
Measuring outcomes of behavior change.	❍	❍	❍	❍	❍

Are there other topics that are crucial?

Q10 Which of the following approaches do you believe would be most effective when teaching Design for Sustainable Behavior topics? (please select all that apply)

	Lecture Courses	Studio Project	Working with Occupants	Involving Practitioners in Studio Critiques	Guest Lectures/Critiques from Related Disciplines	Case studies	Post-occupancy evaluation
Theories of behavior and Design for Sustainable Behavior.	❑	❑	❑	❑	❑	❑	❑
Designing interiors for sustainable behavior.	❑	❑	❑	❑	❑	❑	❑
The ethics of encouraging sustainable behavior.	❑	❑	❑	❑	❑	❑	❑
Understanding sustainable building science.	❑	❑	❑	❑	❑	❑	❑
Measuring outcomes of behavior change.	❑	❑	❑	❑	❑	❑	❑

Q11 Which of the following forums do you believe would be most effective at increasing faculty knowledge of Design for Sustainable Behavior?

	Very Ineffective	Ineffective	Neither Effective nor Ineffective	Effective	Very Effective
Continuing education courses.	❍	❍	❍	❍	❍
Literature: books, journal articles, videos, websites, etc.	❍	❍	❍	❍	❍
Dedicated conferences.	❍	❍	❍	❍	❍
Online training.	❍	❍	❍	❍	❍
Workshops.	❍	❍	❍	❍	❍
Certification programs.	❍	❍	❍	❍	❍

Are there other forums that can increase faculty knowledge?

Q12 With Design for Sustainable Behavior strategies in mind, please indicate the extent to which you agree with the following statements. (click here if you would like to see the strategies again).   It is ethically acceptable for interior designers to use Design for Sustainable Behavior strategies:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
When they believe more sustainable buildings can be achieved.	❍	❍	❍	❍	❍
Only when occupants are aware their behaviors are being influenced.	❍	❍	❍	❍	❍
As long as occupants indicate that they value environmental sustainability.	❍	❍	❍	❍	❍
Only in public spaces.	❍	❍	❍	❍	❍
Only in private spaces.	❍	❍	❍	❍	❍
When special needs populations (elderly, infirm) are among the occupants.	❍	❍	❍	❍	❍
In spaces designed for children.	❍	❍	❍	❍	❍
When the client / owner of the space agrees but occupants are not consulted.	❍	❍	❍	❍	❍
When there is a financial gain for the client / owner.	❍	❍	❍	❍	❍
Only when these strategies do not cause occupants confusion or harm.	❍	❍	❍	❍	❍
When occupants are not involved in the design process.	❍	❍	❍	❍	❍

Are there any situations or comments on the ethical application of Design for Sustainable Behavior you would like to add?

Which university are you currently employed with?

Is you program CIDA accredited?

❍ Yes

❍ No

What is your current position?

❑ Professor (full, associate, assistant)

❑ Instructor / Adjunct

❑ Teaching assistant

❑ Chair / Dean / Director / Head

❑ Other: _____

Please indicate your age:

❍ 21 - 40

❍ 41 - 60

❍ 61+

Gender

❍ Male

❍ Female

How many years of teaching experience do you have so far?

❍ 0 - 2

❍ 3 - 5

❍ 6 - 9

❍ 10 - 14

❍ 15 - 19

❍ 20+

6.

How many years of practice experience do you have so far?

- ❍ 0 - 2
- ❍ 3 - 5
- ❍ 6 - 9
- ❍ 10 - 14
- ❍ 15 - 19
- ❍ 20+

What are your current research interests?

Credentials and Affiliations (select all that apply)

- ❑ ASID
- ❑ IIDA
- ❑ IDEC
- ❑ EDRA
- ❑ AIA
- ❑ LEED
- ❑ EBD
- ❑ Other _____

Please select all the degrees you've acquired and include your major/s in each one:

- ❑ Associate _____
- ❑ Bachelors _____
- ❑ Masters _____
- ❑ PhD _____
- ❑ Other: _____

This survey is part of a larger research project with the next phase consisting of short interviews. Your opinions and feedback are very valuable and we would like to hear from you!   Are you interested in participating in the interview phase? If so please provide your email address below.

❍ Yes - (please provide your email) _____

❍ No thank you

8.4. Appendix – 4

Code meanings for barriers and remedies.

Code	Description
Bar – Fa – Bel	*Faculty*'s lack of *belief* in DfSB as a *barrier*
Bar – Fa – Kno	*Faculty*'s lack of *knowledge* in DfSB as a *barrier*
Bar – Cur – Pra	ID *curricula*'s *practical* approach to teaching as a *barrier*
Bar – Cur – SS	ID *curricula*'s lacking a strong foundation in *social sciences* as a *barrier*
Bar – Cur – Cro	A *crowded curriculum* as a *barrier*
Rem – Fa – Que	*Remedies* for overcoming *faculty*'s lack of knowledge like those in *questionnaire*
Rem – Fa – New	*New remedies* to overcoming *faculty*'s lack of knowledge

8.5. Appendix – 5

Coded summary of an exemplar interview transcript

Name	Conversation	Codes
Researcher	**Industrial designers have been working for about ten years now on a field called DfSB based on the idea that designers whether they intend to or not do influence behaviors through the creations that they make, so they thought how about we use that to encourage people to act more sustainably whether its socially or environmentally. My research is looking at taking this idea and incorporating it into ID, specifically ID education. Now the field encompasses a number of things, it relies heavily on fields such as social psychology, consumer behavior environmental psychology and things like that. So the research looks at this area in general and particularly in ID education.**	
B	Ok, good.	
Researcher	**Great can we start by talking a little but about you, your current position and courses that you teach?**	
B	• Assistant professor • Teach studio for incoming and last year students • Materials resources and assemblies, building systems • Practiced interior design and architecture for 15 years before teaching	
Researcher	**Where would you say topics such as sustainability and human behavior fall into the courses that you offer if they do?**	
B	• "I think that our approach is to integrate sustainability and behavior into required studio and support courses. That is what we intend to do and what we hope that we're doing" • In our first year we have a design thinking course "I don't know if we're doing this now, but I think that course would be a great opportunity to integrate more of the thinking that I believe you're suggesting."	Cur – Met – IvS Cur – Met – Cou
Researcher	**Does your program make a clear link between sustainability and behavior and do you think it's covered in human factors classes?**	
B	• It may be part of human factors course. Everything they learn in that or another class should "become part of their studio projects" • However designing something to intentionally motivate good sustainable practice "no, I don't think that we talk about it that directly, but I think it's a fantastic idea" • "I think we don't do it intentionally enough"	Cur – DfSB
Researcher	**Have you heard of the term DfSB before?**	
B	• "with design we acknowledge that we encourage all kinds of different experiences, and all kinds of actions, and we motivate people, encourage people, and/or lead them to do many things, with what, and through what we design" • "But I don't think that we call it out separately as sort of DfSB,	Cur – DfSB

	no we don't."	
Researcher	**From your understanding of it so far what do you think are some strengths or challenges for the field?**	
B	• One challenge is that it is important to recognize DfSB for what it is but without separating it from good design • It may be two fold, DfSB should perhaps be recognized as its own issue, but not taught solely in isolation from good design • "my sense is that unless we look at it in a more targeted way, unless we do it in a more targeted way, where we actually call it, DfSB, and talk about it a direct way that we're probably not going to get to a vision where its comprehensive and assumed"	Cur – Met – IvS
Researcher	**So it kind of needs to be defined for what it is and what it includes, but then at the same time not to be separate from what good design is?**	
B	• "perhaps one of our challenges is the assumption that DfSB would always be part of our students work and and ID education, but perhaps it's not something that we talk about in a very direct way -- and so it's entirely possible that we're not addressing it as much as we could be" • Maybe we need a method to remind faculty to address it directly, to make sure we're including it	Cur – DfSB
Researcher	**That might link into my next question, the survey that I sent out asked faculty whether they teach DfSB and whether or not it's part of their programs. Some people said yes it exists some people said it's clearly there. Then I went back and reviewed some of the prominent programs and I looked at their online material so their mission statement, course description and syllabi and I couldn't find anything that talked about intentionally changing behavior, why do you think I found that?**	
B	• "that doesn't surprise me at all" • "there is a huge amount information that needs to be delivered to students in a relatively short amount of time" so much of the time goes to teaching students "about conventional existing practices (…)why this is a good thing and why it's important, but we're not as much posing the question about how do we think we might actually design in order to be able to motivate or change an occupant's behavior" • This topic needs to be addressed more as a design thinking exercise where students are more actively involved.	
Researcher	**So do you think it exists within the courses but it isn't mentioned, do you think it's implied?**	
B	• "I think currently it is lightly implied" • "you don't see it in the syllabus directly, but my guess is, you do see things about sustainability" and there are examples like "we think about energy sources and how building systems are monitored, it could be as simple as where is the thermostat	

		located and is it manually controlled, or digital or remote (…) but I don't describe it as DfSB in my syllabus right now, it's just kind of under that larger category of designing sustainably"	
Researcher		**The other question that the survey asked is how would you define or describe DfSB, and list some of the literature that they teach it. Not many faculty were able to define DfSB – does that surprise you? Do you remember that question -**	
B		• "I am not surprised you didn't get much back on that" • It may be due to a separation "in the disciplines, maybe not as much in practice, but certainly in education" • And textbook resources used for classes focus "very much just facts, not so much the behavior"	
Researcher		**In industrial design literature concerning DfSB, one of the reasons user-centered design which they define as involving the user in every stage of the design, from design development prototype testing revisions and reiterations and final product. And one of the reasons they do that is to be able to gage ethical questions so, to what extent is it ethical for a designer to influence peoples' behavior. And there was a question in the survey about ethics. Do you think there is an ethical discourse that needs to be introduced to DfSB?**	
B		• Generally students are altruistic and they want to do the right thing "even if that means engaging clients in conversation or educating them and certainly having users or clients involved in all stages of the design process - that's certainly going to motivate them and help them to be supportive of why things are designed the way that they are. Understanding this could be motivate clients and users to change their behaviors to act more sustainably" • Interior designers are hired to provide a service and it is rare that DfSB would be directly included within their contract • If DfSB is brought up by the designer and shot down by the client than the designer needs to decide whether or not they want to continue with the project	Dis - Ind – Edu Eth – Why
Researcher		**You inspired a question, you reached a point where you said the client shut DfSB down, so what are your thoughts on the designers proposing designs that do change behavior but without the clients knowing that that's what it's doing, that's an ethical question too – do you do that, is that ok?**	
B		• "Absolutely" • Interior designers are hired for their expertise "as long as you're fulfilling the requirements the client has contracted for, then you're free to also bring other benefits to the table" • The problem might be when there is extra cost associated with DfSB "we can't lie, tell them it cost more for some reason other than the truth" • "But wonderful if it provides them with some benefits that they are willing to pay extra for and it just so happens that in addition that also reinforces sustainable behavior, then that's fantastic and	Eth – Why

	we make no apologies."	
Researcher	**Since we're on the topic of clients, how can we get clients excited about this and get them to allow us to do perhaps some extra work on the front end because you have to do some behavioral studies to understand why these behaviors are happening, and like you said it is not typical in an interior designer's contract, so how do we get clients to recognize the importance of this and pay us for it?**	
B	"that's the bottom line" - Designers as a whole "would like to provide many services that we believe would improve the quality of society or of human life or our client's individual users, but it's a question of often how can we be compensated" "and I can say from my own personal experience, I have had some, but limited success in actually being able to motivate changes (…) in the priorities of the client when it comes to sustainable issues and that's sad" "I think that that has improved some overtime" "in general the best success I've had is in one of two ways, one with larger organizations like institutions and universities (…)where it's institutionalized that they must participate whether they like it or not, part of their budget is going to have to be spent on doing behavioral studies upfront or whatever extra services may need to happen in order to design this way. That can be incredibly successful." - The second successful example is on the individual or private client level, "somebody who comes to the designer with a general sensitivity, already feels that this is something that could honestly (…)benefit their bottom dollar" in this case it's "almost like a marketing strategy -- they believe that they can market themselves through being recognized for designing for DfSB. -- Isn't it wonderful that (…) we've designed for sustainable behavior" "I am always a little skeptical of a client's motivations – I may wonder if they're greenwashing, if they truly are or aren't" interested in being sustainable. - How can we overcome greenwashing, it comes down to clients respecting our profession and placing confidence in our suggestions: "really it comes down to respect for the expertise of design professionals, that the more respect and trust we have, and the more confidence that the public, clients and/or users have in us, the more likely they'll be to trust our suggestions that this a worthwhile expense"	Dis - Ind – Cli Dis - Ind – Cli Dis - Ind – Edu
Researcher	**I am going to move us back into education if that's ok, so from everything that we've discussed so far do you think it is important to incorporate DfSB within interior design or is it beyond the scope of what we do?**	
B	"oh no, I think it's a fantastic, absolutely" "this is entirely in our domain and we have the potential to make a difference whether we are asked to or not as interior designers"	Imp – DfSB

	• On an educational level "if you survey our students they would say they are absolutely interested in learning about this and being able to provide it."	
Researcher	**How would you go about teaching it, is it more of a pillar or more of a senior elective?**	
B	• It goes back to the idea of whether we should call it out as a separate issue, or integrate it seamlessly • So it could start off in the curriculum as "a separate elective, as a way to start, or for people who are particularly interested in that area" • But then the idea that "we are really going to affect people's behavior, then I think it needs to be part of a core curriculum" and "would see it as integrated into multiple classes"	Cur – Met – IvS
Researcher	**Can you think of any courses within your program that could be an easy first step to integrate these thoughts into?**	
B	• Human factors courses are probably the most obvious places for it • "I keep going back to the studio, I think we could here and in other universities I would imagine. Yeah, we can have studio projects that are specifically around the topic and are tailored to it" • This would be "a fantastic way to address it because you could have more time for investigation and questioning" • Probably not in the first year but more towards second year • It could be "the main, the driving goal of a particular project or it could be a component of any studio project - I think that would be the most helpful"	Cur – Met – Cou Cur – Met – Pra
Researcher	**DfSB is inherently interdisciplinary and relies on knowledge form multiple areas; how do you think this can best be taught in ID courses? Do we need to acquire all the knowledge ourselves or do we need to reach out?**	
B	• "we would kid our self" if we thought we could teach it all ourselves. • Two thoughts, the first "within any individual interior design department we have faculty with certain strengths so relying on those that might have more experience or expertise in this area and bringing them in almost like consultants on different projects" • The second is that "one of the huge benefits in my mind, why I love working in a university, is that we have the benefit of all of these other disciplines (…) we can actually have not only faculty collaborating to design coursework or to do their own individual research but to actually teach the classes and have the students working together" • "I am sure that we have multiple other disciplines that would be interested in working collaboratively" on this topic. • A studio project can be "directed at not only designing for this behavior, but perhaps documenting it and maintaining the data for analysis."	Cur – Met – Col

|		Cur – Met – Pra
Researcher	**I am going to share something with you, a lot of interviewees were very excited about the idea of collaborating but then they hesitate, so I was wondering if you can point to any challenges maybe using examples form your current collaborations?**	
B	• There are a number of concerns with collaboration "we fear one that its not going to be as efficient, we're not going to get done all the things that we normally expect we would be able to do in a particular course or over a particular amount of time for the number of credits students are earning" • In a way it's a "change" and you need to "alter the expectations of the coursework in order to be successful" • "but what I see is a lot of interest upfront and then some fading as the project moves on" • "when we try to collaborate more we don't often (…) build in extra time for the teaching process, the amount of coordination that needs to go on, especially when we start to set-up this sort of collaborative coursework" • And then there is the challenge of students themselves "many really resist coursework that requires working collaboratively with other students" even though once they graduate they will have to work collaboratively for most of their career, perhaps that is the biggest challenge for the students • It's also hard to measure students learning outcomes or experience for some "they'll say no this is awful and this is painful, but I think over time (…) they (…)understand the value of collaborative work"	Cur – Met – Col
Researcher	**What do you think are some challenges to incorporating DfSB into interior design education?**	
B	• "the faculty themselves having the subject matter experience, we can talk about it in general, we can teach about it in general ways (…) "we do it and its important to us, but we don't necessarily have case studies and precedents to draw from at the tip of our tongue, so I think one challenge is perhaps to more thoroughly educate faculty on how to do this well, to understand the topic better"	Bar – Fa – Kno
Researcher	**How would you go about doing that, increasing faculty's knowledge of DfSB?**	
B	• It can happen on an individual level where a faculty would feel they need to be an expert on it and they will find the resources and they would self-educate • Learning through collaborating with other faculty in the social sciences for example "so we're learning as we're doing by collaborating" • Through IDEC workshops, which may not turn someone into an	Rem – Fa – New

	expert but "it can give a strong foundation" • Workshop within universities for faculty 2 – 3 days of charrette projects to practice ideas that they can share with students later	Rem – Fa – Que
Researcher	**Do you think there is a difference between using a product to change behavior and using a space to change behavior?**	
B	• The boundaries between interior design, industrial design and architecture are changing and there are overlaps due to technologies • Product and interior design are "intrinsically linked" as our behaviors in relation to products "always happen in some sort of designed environment" • "most of what we see in innovation, with products sometimes, it's about the product creating its own virtual environment in the users' mind, but the fact is we live in a tangible world, so I think the product is not good enough" • "They're each all-the-more powerful if both are considered in relation to each other"	
Researcher	**Is buying a new product and its trying to influence your behavior is that similar to you get hired to work in this building and its trying to influence your behavior?**	
B	• There is a question of free will, products are often bought by choice, however in a job a person has to work in a particular building and they don't get to choose that so much • However another way of looking at it is that we're coerced into using products for work as well, so products aren't always used freely • "as long as it's not something that you disagree with, then I think that it's fine and it's wonderful" • It's important to recognize that we cannot force people to do anything "we like to think that we create opportunities for people to choose to have wonderful experiences, or to be, in this case, to be proactive and practice a behavior that will benefit all of society" • Most people would want to practice sustainable behaviors "if my environment makes it easier for me to do them, then that's great"	
Researcher	**Within DfSB strategies are organized on an axis of control that range from informing people about behaviors to determining their behavior such as you can only turn light on in a hotel room if you insert the keycard in its place. So do you think this access of control is applicable in ID or do we need to think of other things? They use this access to sort of understand why a behavior is occurring and based on that choose what strategy to use.**	
B	• Yes, in regards to the strategies "I think its wonderful" • The problem is that "we're not making designers who are experts in any one thing, and they are skilled, but not experts in human behavior" • In order for students to be able to realize on a deeper level the effect of their design on behavior "they would require more	Cur – Con – Pro

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	learning and more education" • There is a keen student interest however in topics like environmental psychology "but they don't know how to make a living doing that (…) how it can be more part of their design work"	Bar – Cur – SS
Researcher	**Do you think that is because it is not emphasized enough through education or practice?**	
B	• Industry could lead the way and emphasis • There is a real interest among faculty in "and what motivates people" similarly among students when they first come in • "but when you transition into the typical workplace it becomes more motivated by the dollar and profitability"	Dis - Ind – Eco
Researcher	**Do you think that's affected the CIDA standards that we're pushing?**	
B	• "I think it's always a balance because we can't ignore industry demands" • Although some firms are starting to do their own design research, students also need to be prepared "for working in more conventional practice and ways of thinking" • We can inspire students and share these ideas with them, but applying them in practice will depend on their personalities, values, and the opportunities they get	Ac,In – Bal Dis - Ind – Stu
Researcher	**One of the main challenges within DfSB is identifying which behavior in particular is creating this unsustainable result in the building. How do you think we can go about identifying these behaviors and targeting them through our designs?**	
B	• Through technological advances, such as using sensors to monitor usage • There may be a cost associated with that but it may be cheaper than hiring someone to watch people	Cur – Con – Uns
Researcher	**So maybe more collaboration with engineers to get those questions in there and answers?**	
B	• "more collaboration with engineers is a fantastic idea" • "we could have the social scientist and the designer and the engineer working together if they can coalesce around the goal"	Cur – Con – Uns
Researcher	**How do you DfSB relating to LEED?**	
B	• "in many ways I have mixed feelings towards LEED" • "in general I feel very positive" • It can go back to the benefits of mandating something or some behavior through LEED - then "LEED becomes incredibly powerful" • "but no document like that is perfect (…) it's part of a bureaucracy so (…) it's not always as nimble (…) and its often difficult to customize large programs like that to the individual needs of a particular user or building"	Dis - CILE – Man

	Dis - CILE – Cri

8.6. Appendix – 6

IRB Approval forms for questionnaire and interviews
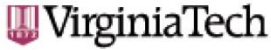
VirginiaTech

Office of Research Compliance
Institutional Review Board
North End Center, Suite 4120, Virginia Tech
300 Turner Street NW
Blacksburg, Virginia 24061
540/231-4606 Fax 540/231-0959
email irb@vt.edu
website http://www.irb.vt.edu

MEMORANDUM

DATE: April 11, 2016

TO: Patrick Miller, Danya Hakky

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires January 29, 2021)

PROTOCOL TITLE: Interviewing ID faculty

IRB NUMBER: 16-322

Effective April 8, 2016, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	**Expedited, under 45 CFR 46.110 category(ies) 5,6,7**
Protocol Approval Date:	**April 8, 2016**
Protocol Expiration Date:	**April 7, 2017**
Continuing Review Due Date*:	**March 24, 2017**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

VirginiaTech

MEMORANDUM

DATE: April 28, 2016

TO: Patrick Miller, Danya Hakky

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires January 29, 2021)

PROTOCOL TITLE: Interviewing ID faculty

IRB NUMBER: 16-322

Effective April 28, 2016, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Expedited, under 45 CFR 46.110 category(ies) 5,6,7**
Protocol Approval Date: **April 8, 2016**
Protocol Expiration Date: **April 7, 2017**
Continuing Review Due Date*: **March 24, 2017**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

VirginiaTech

MEMORANDUM

DATE:	October 9, 2015
TO:	Patrick Miller, Danya Hakky, Lisa M Tucker
FROM:	Virginia Tech Institutional Review Board (FWA00000572, expires July 29, 2020)
PROTOCOL TITLE:	Survey of Interior Design Faculty
IRB NUMBER:	15-904

Effective October 9, 2015, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the New Application request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As:	**Exempt, under 45 CFR 46.110 category(ies) 2,4**
Protocol Approval Date:	**October 9, 2015**
Protocol Expiration Date:	**N/A**
Continuing Review Due Date*:	**N/A**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
An equal opportunity, affirmative action institution

Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

VirginiaTech

MEMORANDUM

DATE: November 16, 2015

TO: Patrick Miller, Danya Hakky, Lisa M Tucker

FROM: Virginia Tech Institutional Review Board (FWA00000572, expires July 29, 2020)

PROTOCOL TITLE: Survey of Interior Design Faculty

IRB NUMBER: **15-904**

Effective November 13, 2015, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

PROTOCOL INFORMATION:

Approved As: **Exempt, under 45 CFR 46.110 category(ies) 2,4**
Protocol Approval Date: **October 9, 2015**
Protocol Expiration Date: **N/A**
Continuing Review Due Date*:   **N/A**
*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

FEDERALLY FUNDED RESEARCH REQUIREMENTS:

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

Invent the Future

Date*	OSP Number	Sponsor	Grant Comparison Conducted?

* Date this proposal number was compared, assessed as not requiring comparison, or comparison information was revised.

If this IRB protocol is to cover any other grant proposals, please contact the IRB office (irbadmin@vt.edu) immediately.

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8.7. Appendix - 7

Faculty explained how DfSB is **implicitly** offered in their programs, their **comments were coded and the organized under the following emerging themes**.

DfSB as a term is not used	Inconsistent and underemphasized	Part of other courses*	Aspects taught but not in relation to sustainable behavior
concepts are covered but not formally using the term "Sustainable Behavior".	Approaches are discussed in general discussions; it is not necessarily presented as a specialty or body of knowledge.	covered as part of sustainable approaches to building systems	We covering environmental psychology, architectural determinism (in Theory) and applied psychology for studio projects (varied), *not specifically for sustainable behaviors*
Discussions include design decisions that will impact occupants behavior	Covers but not that explicitly	discussed as product not area of design	we discuss the placing of design features to encourage behaviors we want and discourage others
Don't use the same terminology	I cover it but it is not specifically required and others might not.	Eco-system model is covered as an approach to sustainable design	we cover design strategies to modify behavior in Human Factors courses *but not specifically referencing sustainable behavior*
I don't think we use this exact terminology	indirectly	In studio projects.	the two issues (user behavior and sustainability) have not been joint this specifically
I know that I have discussed the strategies described in both persuating and determining without calling it "design for sustainable behavior	It is a small part of many classes. It is also covered in one optional elective	integrated into interior building systems course and perhaps other courses	
It does not subscribe to the model stated above this question	Lectured on often but only one project uses sustainable design for behavior	It is discussed as part of our office planning and design course.	
sustainable behavior is encouraged throughout the curriculum but I'm not sure that it is explained explicitly as behavioral sustainability as described here	Our program does, but not my course specifically.	It is part of the Environmental Controls courses and in design studios.	
We do not use the terminology, but do incorporate these principles.	Some of these strategies are discussed and students offer examples as well of new things that they are seeing introduced	this is discussed as part of design psychology principles and sustainable design	
we dont always call it that...	Some of these types of item are	We cover design strategies to modify	

	mentioned, but not extensively.	behavior in Human Factors course but do not specifically reference sustainable behavior	
We don't call it Design for Sustainable Behavior but students learn to design for sustainable behavior.	there is more emphasis on sustainable materials and systems	We covering environmental psychology, architectural determinism (in Theory) and applied psychology for studio projects (varied), but not specifically for sustainable behaviors.	
we don't use that name.	studio translations are not consistent.		
we don't use the the term sustainable behavior but based on the explaintation shown, it is part of the conversation especially in the design studio courses	This is up to the discretion of individual instructors, especially studio instructors, so it varies a great deal across curriculum.		
We may not use that term, but that's what we do.	Usually presented as a side story of interest.		
We speak about informing clients, creating design that makes it easy for people to behave in more sustainable ways (like making the recycle bins easy to use and find) and the like, but I really didn't know this was an official area of study. I'm happy to learn of it!	Moderately. For example, LEED criteria relate to energy use and other occupant decision-making beyond initial construction. Sustainable design strategies can determine, persuade, and inform occupant decision-making and this is necessarily part of the conversation. However, *my sense is that these strategies can be more explicitly taught and articulated.*		
We undertake to integrate al three categories int othe curriculum overall, but we do not always explicitly lable each category each time we deliver it to students.	we are not identifying this in the curriculum but sometimes discuss these types of ideas		
Yes, but we refer to it as environmental design and human factors. Sustainability is implied in our curriculum.	We cover things like this but don't broadly categorize it like this		
Yes, I"ve discussed strategies such as these with my students, particularly on their senior capstone projects, but I did not know it was labeled as this. I	we don't use the the term sustainable behavior but based on the explaintation shown, *it is part of the conversation especially in the design*		

first completed a project in the early 1990s that used many of these strategies mainly to augment the customer's awareness/knowledge (and was published with that project).	*studio courses*		
	Yes, but only (maybe) in the studio environment and not in the depth you present here. We have a strong focus on environment/behavior, but different faculty emphasize this different ways. I may be the only person who discusses this issue with my students.		
	yes a little bit		

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8.8. Appendix – 8

Faculty explained **how DfSB is integrated into multiple courses** within their programs. Their **responses were arranged under the following themes** that emerged from analyzing the comments:

Part of Human Factors	Part of Sustainable Design	Part of Building Systems, lighting, materials	Used synonymous with sustainable design	Marginally addressed
"Addressed as part of multiple studios as well as support courses such as *Human Factors* and Building Systems."	"Certificate of Completion in Sustainability"	"Addressed as part of multiple studios as well as support courses such as Human Factors and *Building Systems*."	"It is discussed at various times throughout the course. Sustainable design is a module within each, but especially applied depending on which project and part of the project we are working on"	"discussed in several courses but not as major topic"
"addressed in some studio classes and in *Human Factors*"	"it is a small part of several courses, *as well as a larger part of a sustainable design course*"	"I integrate it as discussion in my classes: *building systems, lighting, etc.*"	"As mentioned earlier, we make a conscious attempt to weave sustainable design thinking into all appropriate courses, since it touches so many areas."	"Strategies included in Topics courses and studio applications; not addressed as a body of knowledge or research"
"In multiple courses students are taught these concept. First semester in a courses on *human behavior in interior environments*, in the environmental systems course, in an advanced *course in environment and behavior* for special populations and in their studios."	"We provide a variety of assignments and projects accross our curriculum that offer different scenarios and design problems to be addressed and *sustainable behavior is a component of sustainable design considerations in these assignments and projects*"	"In multiple courses students are taught these concept. First semester in a courses on human behavior in interior environments, *in the environmental systems course, in an advanced course in environment and behavior* for special populations and in their studios."		"integrated into studio courses after general sustainability topics are covered marginally in one class"
	"as part of the discussion of sustainability"	"interior materials, construction methods, building systems"		
		"when discussing human needs they are often		

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		discussed as behaviors as well. Energy consumption as well as carbon footprint of materials/ finishes, FF&E are discussed relative to specification behaviors as practitioners"		
		"Covered distinctly in *two environmental systems courses, supported in two materials courses*, and reinforced as a touchpoint across the entire studio sequence."		

8.9. Appendix – 9

Other **barriers** identified **by respondents.**

Human tendencies: faculty, students, management	Resources and research	Tight curriculum – DfSB unsuitable for undergraduate	Other	Time	Cost	No barriers
• Awareness • Departmental support. • Like any other subject, one needs to be interested in presenting the information and requiring the students to consider these design parameters. In a four-year degree program, we have a lot to cover for CIDA, but if we want to teach in this field, we must take responsibility to do the work to teach it well. • Laziness • Legacy perspectives of what interior design is. • Human stubbornness, ignorance, and general misinformation	• A cue class is needed for instructors to learn the "kindergarten" facts and then a good text book. • There needs to be a broader and deeper set of information resources that link sustainable design practice to the natural ecosystem, aspects of human behavior and human biology and validated metrics for continuously assessing the outcomes of sustainable design interventions that incorporate human behavior. • Convenience and availability of high-quality, introductory-level materials to support this topic. We have tried to teach environmental	• A full submersion to theoretical framework may not be appropriate for undergraduates, but concepts, implications, and applications are. • I think DfSB is a reasonable goal for all design projects as the interventions can range from simple to complex. However, as a concept it is hard to teach in depth at the undergraduate level because there are already so many expectations for course objectives from CIDA. • it could be one facet of a larger course, but I think that a course dedicated solely to DSB is not sustainable because there are so many other mandatory courses the students must take and with a 4 year education there is simply not enough time. • Just the amount of credit hours taken up	• Media, propaganda, HGTV • I believe this is a "new phrase" to describe something we already do....however, with the addition of new products. • I don't see barriers as much as it is just another theory and practice to incorporate. There is always room to in the curriculum to teach more, but it would be making behavioral issues a priority. When talking about Human Factors or Environmental Psych it could	• just not enough resources or time • Other than time and resources... no • Time and student interest in building a knowledge base. • Time! • Time	• Cost Implications • Research findings and cost of technology • The upfront cost and research.	• No- it is just a shift in focus regarding topics already taught. • I don't see barriers as much as it is just another theory and practice to incorporate. There is always room to in the curriculum to teach more, but it would be making behavioral issues a priority. When talking about Human Factors or Environmental Psych it could be another theory. • There are no barriers to teaching "Sustainable Behavior" in interior design, specifically for those who have professional practice

• Older faculty members who find sustainability to be limited to materials and finishes. • Skeptics (generally technologists) who think that user behavior makes minimal to no difference in the performance of the building. • The leadership at certain schools may or may not buy into this design methodology • Traditions of what we focus on in the profession, the expectations, this requires a culture shift in interior design, • It is simply being aware enough of the subject to incorporate it into the curriculum. • Educating adjuncts and changing the culture and focus when teaching design	psychology broadly (of which design for sustainable behavior would be a part) and have struggled to find variety in the number of available resources and have been relatively dissatisfied with the limited resources that are available. We would be very interested in adopting and utilizing more high-quality instructional materials (including textbooks, readers, case studies). • Mostly it's where to put it in an over-extended curriculum; the entire INT body of knowledge continues to grow... and grow... and grow... • need more research into this • Other than time and resources...no. • Promoting this as one more "CIDA standard" to add to the list would make it a barrier. My sense is that this should be	for other more basic coursework, which is why I think it should be incorporated in studios • Like any other subject, one needs to be interested in presenting the information and requiring the students to consider these design parameters. In a four-year degree program, we have a lot to cover for CIDA, but if we want to teach in this field, we must take responsibility to do the work to teach it well. • Our curriculum is already very tight - it can be hard to find room to introduce another topic • Promoting this as one more "CIDA standard" to add to the list would make it a barrier. My sense is that this should be holistically integrated into how we teach sustainable design. I agree that our current instruction probably under-emphasizes the importance of human behavior over the life-cycle. Definitely an opportunity for a new textbook (ideally as a	be another theory. • Not that I can think of. Making it explicit is probably more of the issue. I'm not sure that a lot of faculty (or people) would consider this separate from good design. • More interior design firms need to model this behavior to mentor and become role models for this important topic! / Some larger commercial firms do this to a great extent, but most residential and smaller commercial firms do not. / It seems like the topic has gone by the wayside since the recession and I am glad to see that this survey will bring it to		experience. While formal materials covering the subject are helpful, the topic is native and talked about even without formal materials. Faculty with little to no formal professional experience usually need more resources to make up for a lack of knowledge, comprehension and application.

| | holistically integrated into how we teach sustainable design. I agree that our current instruction probably under-emphasizes the importance of human behavior over the life-cycle. Definitely an opportunity for a new textbook (ideally as a part of a broader discussion of sustainable design rather than as a separate, additional resource), or possibly in the form of a journal article.
• Research findings and cost of technology
• Resources and references. Most of mine have been gathered through professional practice, site visits or "running into" examples. Again, I didn't know these strategies had a title.
• The upfront cost and research.
• More research in the specific area.
• just not enough | part of a broader discussion of sustainable design rather than as a separate, additional resource), or possibly in the form of a journal article.
• The most compelling barrier is integrating it along with everything else into the curriculum.
• This area of specialization should be part of a course on environmental controls, but there are many things to teach prior to this concept- I see this as a senior level concept or grad concept
• Too many requirements by CIDA limit any flexibility in curriculum | light again.
• Overthinking the value of our design decisions to actually influence all human behavior to fit our design intentions. There is a fine line between gimmickry/ill informed design intent/poor timing and human behavior over the life of a building.
• There are no barriers to teaching "Sustainable Behavior" in interior design, specifically for those who have professional practice experience. While formal materials covering the subject are helpful, the topic is native and talked about even without formal materials. Faculty with | | | |

			little to no formal professional experience usually need more resources to make up for a lack of knowledge, comprehension and application. • Too much coursework is hypothetical, so there is little opportunity for students to test or measure outcomes of design interventions			
	resources or time					

8.10. Appendix – 10

Are there any situations or comments on the ethical application of DfSB in ID?

Sustainable design is a good behavior	Design influences behavior all the time, DfSB is no different	DfSB should not apply deterministic strategies	Occupants should not be harmed
• I found it awkward to respond to some of the questions that seem to be trying to shape an argument regarding the ethics of people KNOWING you are designing for sustainability. We design for safety without getting anyone's permission. Do people have a right to reject design strategies that serve our environment? I hope not. • I can't see that influencing behavior to do something that is positive (recycling) could be considered unethical, even if it is encouraged without a person's knowing that they are being influenced in that direction. If you were encouraging a negative behavior (throwing the trash on the floor), that would not perhaps be "ethical" but more likely it would be described as unacceptable not unethical. • Interesting question - some solutions might be objectional but I dont see ethical problems with influencing people to be sustainable.	• As a design educator we teach our students a number of ways that their design choices influence the occupants, through color, wayfinding, anthropometric designs, building orientation, lighting, etc. I don't particularly feel that understanding and employing sustainable behavior strategies is more unethical than these other design strategies. It is simply another facet of the designed environment. It would however, be unethical to employ design strategies in this or any of the other areas mentioned to knowingly cause harm or confusion for occupants. • we influence users all the time and do not consult with them - example milk in the back of the store. • What could be unethical. We influence behaviour in all our design solutions. What are you getting at? • If you're implementing a design that improves human health by improving the air quality and quality of life in a building (which in inherent in sustainable design), then I don't think any	• While I commend the concept, the thought that a items would be designed to push people out of a shower is way too intrusive. More subtle reminders are more appropriate • In the example of moving an elevator to a hidden place, this is a decision that negatively impacts those needing to use the elevator. There are options that do not have negative consequences for people groups. These are the options in which I am interested. • overthinking it! what maters it not the use of "Sustainable Behavior" but the level of control that is used. • It was a bit difficult to answer the questions above because I think it highly depends on the design strategy -- some are more innocuous than others. Some strategies definitely need user input and others may not. When we implement highly deterministic features without consulting occupants, I expect there would be psychological reactance that could compromise building performance (for example, if an occupant is angered and goes out of his/her	• Interior design is designing around occupant health, safety, and welfare so ethically, if you comply to those three then all other design solutions complies • First, do no harm. Behavior change through design strategies do not always need to be consensual. • As long as the behavior change does not cause psychological or physical harm to the occupants and creates significant, measurable positive environmental change, I don't see a problem with designing for sustainable behavior. There is no reason sustainable design can't just be good design, an we don't question whether good design is ethical.

	occupant permission is necessary. Occupants may simply be uninformed and choose unhealthy courses of action due to their ignorance. • I don't understand the problem here. In consumer behavior where the enviormnent and variables are manupulated all the time to evoke a behaviour of positive sales nobody asks people if they are OK with a particular color, or light level or music? if the designer meets the safety/comfort and space needs I think incorporating the sustainable ideas in a creative fashion to evoke positive behavior should be encouraged. I don't undertsand why the question of ethics comes in play here. • The framing of the answers above seems disconnected from the pragmatics of design practice. Designers are involved in making many decisions about a space that are related to understanding clients, client behavior, etc. designing for sustainable behavior does not need to be an intrusive or demanding solution. Designers have often designed spaces in ways that preclude user choice; designing for sustainble choices does not require an occupant to take a specific action, but will present the opportunity for consideration of action (and perhaps a different end).	way to be environmentally wasteful). • I support information and persuading, but not determining strategies	

	• Design for Sustainable Behavior is important even if there is a higher cost for implementation. • I think full disclosure is always right, but for the most part, the need for humane and sustainable architecture and interiors will result in ethical design.		

Critique of question	Other comments
• This section poses a wicked question: ethical practices/applications are ALWAYS necessary (not just in the case of design for sustainable behavior), but these particular clauses attempt to fog the question with "only" and particular user groups – • I found this question confusing. Half way through, I couldn't tell if I was supposed to agree or disagree (based on my thought). • I don't think the above question is very well-worded. • These questions are confusing in how they are worded. • It is imperative to always give choice, and not to cause disorientation or forced behavior that infringes on people's sense of self and control of own environments, the questions above could have been framed differently... • This is a confusing series of questions	• These are misleading questions. It is unethical if your project is limited to a particular aspects. (Hiding an elevator from the public view and encourage the public to use attractive stair case is unethical because you create a social barrier to persons with disabilities. Interior design deals with complex problems. I am not convinced that sustainable behavioral issues that interior design industries should address • Integrating design features and observing behavior in an undergraduate course should not raise ethical concerns, only in upper division or graduate studies that use people as research subjects. • It's like ethics in general...people do not think they are doing harm, or their choices do not impact others. Lot's of denial. • consideration might need to be taken for culture or religion • Just have some kind of regulation/penalty for the application of some solutions explained to users as sustainable, but which in reality are meant for profit. • Perhaps Design for Sustainable Behavior should or could be linked with Universal Design and both could become more normative. • I think this is an area largely unexplored and misunderstood by many designers. Clearly, more study and targeted studies are needed. • In the assessment of ethical design solutions it is always advisable to begin with a deontic approach, that is, the use of the standard "...what we ought to do..." not what we want to do, or what is expedient, in order to ensure a sustainable outcome. There is now too much information regarding the deleterious impact of poorly considered design solutions that do not incorporate sustainable approaches; these oucomes, ,imperically verfied, demonstrate that the development of sustainable design solutions, or conversely the continued use of antiquated approaches that are not sustainble, do not merely effect the users of the

	built environment but everyone on the planet and as such must be considered the broadest possible context.
	• Just make sure students learning these principles theoretically, understand the ethical implications of imposing them on actual end users...over the life span of a building. Big difference.
	• The above opinions are based on the assumption that these strategies are not mutually exclusive, i.e., that they-- potentially all of them at the same time-- can (and generally should) be used in parallel, in various concurrent combinations. The ethical conflicts would seem to arise out of a belief that certain strategies on this continuum are intrusive (e.g., that automation of systems is "deterministic" and inherently less humanistic than "informing" and is, perhaps seen as less contributory to the emergence of sound sustainable behaviors?). I feel the idea (and significance) of these strategies being presented as a continuum deserves more detailed thought and articulation.
	• People should agree to be observed and why.
	• I don't think it should be shown as an ethical issue - it's just the right thing to do. When you say someone should do it so they are ethical then it makes them feel forced. This is a design that just can happen as part of the process.
	• As a designer there is a responsibility to educate the client of this topic to peak interest and forecasting the results of the design impact I presume the owner and occupant(s) and majority of the people involved would want to participate.