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# Sensory-Cognitive Interior Design Model for Improved Learning Outcomes in Art and Design Institutions

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## Abstract

The current research is a critique on the education community that follows a single standard of design and space. Moreover, it is expected to cater all forms of study from the primary to the higher education sectors. This statement stands true for a design school as well. Whereas, the indoor built environment contains the ability to affect and unfolds the mind of the students and also provides social opportunities, which in turn, influence the ability of the learners to think from different perspectives. This study mainly strives to enable the learners to interact with the world around them and to grow their learning capacities rather than being limited to their desks. Furthermore, it also allows them to be able to speak freely without any mental constrains and fears that are usually uphold by the traditional classical settings of the classroom. Eventually, the understanding of these connections becomes the basis of the 'Design Center' that aims to use the interior design elements to create a chance of new meetings rooms. Hence, allowing it to become a stimulant for an active learning space.

**Index Terms:** Active learning space, Cognition, Design Studio, Interior design, Spatial behavior.

## I. Introduction

Human being perceives and collects information from the environment and interpret it by using their five senses namely; sight, touch, smell, taste and hearing. Each of these senses play their role by collecting the information from the environment and then send it to the brain which, in turn, interprets this data. The process of interpreting the information is part of the cognitive functions of the brain, which also contains thinking and remembering data. As previous studies indicate that the role of each of these senses in interior design are:

- ✚ Sight\_ takes into account the light, aesthesis shapes and spatial information of the environment;

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- ✚ Touch\_ enables us to feel the textures of the surface of objects present within the space. E.g. smooth, rough, soft etc.
- ✚ Hearing\_ considers the sound level in the environment. The requirement of it varies in accordance to the type of space humans are present in.
- ✚ Smell\_ absorbs and discerns the scents present in the air which can lead to space association. Moreover, it can function as a trigger to activate memories related to that scent.
- ✚ Taste\_ does not have much of the role within interior design [1].

The information of the environmental elements sent to the brain by perception and cognition evokes a reaction from the brain that is known as spatial behavior. The collaboration of these mental processes creates a response of the person to their present environment.

Likewise, the social interactions of a person with the environment he lives in has a direct impact on how they perceive the space and relates it to their comfort level. Each person sets certain boundaries with varying degrees (be it intimate, personal, social or public) that defines their relationship with those around him/her. Intimate space refers to the space that is within close proximity of the body of the individual; whereas, personal space is the one, in which a few selected people are allowed to be within such as family and friends with whom private conversations are held. Social space is where interactions occur for short durations and are not so frequent. Public spaces are usually considered as undesirable for any sort of interactions [2]. The interior setting, which violates any of the aforementioned set limits, may result in discomfort for the users and harbors a negative perception or experience of that interior environment.

Furthermore, an environment setting can introduce different types of spaces, which can influence interactions between people including private, territorial and crowding. While the interacting discussion in the previous section was based upon the distance between people; the current discussion of interactions is based upon the physical nature of the space. A private setting allows people to be either approachable or unapproachable. Interior environments can enable that by creating the physical spatial arrangement as such or setting up visual and audio obstructions. The concept of territoriality helps people to command that space in terms of granting or denying any sort of interaction. It helps people to feel a sense of security from the approaching strangers. Crowding occurs when both personal space

and the sense of territoriality are not the concern of the area. Depending on the intentions of the space, crowding can be endurable when the person is aware that it is only for a limited time. It can only be tolerated for entertainment purposes; otherwise, it can lead to psychological unease if unwanted, regardless of the situation they are in.

#### *A. Elements that have Influences on Human Response and Behavior*

The interior elements that exist within a defined parameter has the ability to factor into the type of people' response [3]. Generally, these reactions to environment are classified into sociological, physiological and psychological respectively.

##### *1) Sociological Response:*

This is tied into the interactions that occurs between the people present within the same environment. The spatial arrangement in spaces such as offices can affect the group dynamics of the coworkers, i.e. it can either be planned to enhance and make it easier to communicate or hinder the process all together.

##### *2) Physiological Response:*

This relates to the physical features of the interior environment, such as functionality, circulation, flexibility and furniture that fulfils the requirements of the space. In addition, the safety and health of the users is as another aspect that needs to be considered. For instance, for an individual's safety, clear guidelines and directions ought to be indicated where a person can reach easily to evacuate the area in hazardous scenario. Similarly, health is taken into account by avoiding the usage of harmful materials and chemicals such as paints that emit fume. Moreover, facilitating the users with furniture pieces that are ergonomically correct so that there is no physical strain on them.

##### *3) Psychological Response:*

If there is any audio-visual disturbance then it can cause discomfort for example, consider a classroom that has not been acoustically treated may sever as a distraction for the students due to the commotion that might be taking place outside it. Another factor is aesthetics which has an impact on emotional level of an individual. As interior designers, it is important to know that what sort of elements of design is suitable in a certain setting.

## *B. Objectives for Interior Design Model*

This project aims to create a design school (for interior and architectural studies) that provides students and teachers an encouraging environment which allows them to perform well in an interactive learning session of student to teacher, as well as student to student. An interior space has the ability to influence the performance, mood and feelings of the users. Hence, the aim is to utilize the elements of design with positive effects to create an interior environment that is suitable for learning design.

Design is generally defined as a process of planning that makes use of the provided information and tools to meet the requirement of the user. The need for design occurs when there is a situation which is not favorable and can be improved, therefore, an investigation is conducted to discover the 'how' that is being referred to the solution for the particular issue of the given problem. Hence, designs are often linked to problem-solving skills. Design Schools are institutions that help in developing the thinking capacities of the students which, in turn, enables them to present solutions that are not only functional but are aesthetically appealing as well. These institutes plan the courses that will best provide the knowledge and skills to the students to create compositions that will fulfil their purpose in the best possible way. Despite that, it extends beyond the limitations of curriculum. The spatial environment also contributes in the learning of the students.

### *1) Types of Classrooms within a Design School:*

The courses taught within the school highlight specific targets to be met by the students. This is necessary in the sense that the type of class assigned to the course can positively impact the outcome of the course. The nature of the classroom is defined by the resources it contains to aid the learning process. There are three main class types found on the campus of a design school:

- i.** Traditional Classrooms to hold theoretical discussions and lessons,
- ii.** Technology infused classrooms– that has installed computer systems to facilitate the students on equal grounds with skills needed to communicate their work,
- iii.** Studios– practical development and application of learned skills

## 2) *Issues in Design Studios:*

Studio classes are strongly linked to education related to arts and design, in which students are learning by creating projects related to their field of study. A design studio is recommended to have a social environment as it allows opportunities to students to learn from each other; be open to the criticism and cooperate with each other. Design Studios have drafting tables that provide students with adequate space on desk to be able to work on large scale projects without worrying about the lack of surface area to produce their work. However, the arrangement of the studios desks and chairs are similar to the classrooms that everyone is familiar with, i.e. endless rows and columns of desks and chairs. Since, humans are creatures of habit, they tend to behave in a similar manner to as they have been in the traditional classroom. A part of environmental psychology theory is that humans tend to behave similarly to the environments, which share common characteristics to one another. Communication becomes restricted and collaboration becomes hard due the conditioning of students in early education [4]. This conditioning also restricts an open interactive session between students and teachers, as due to past experiences and an invisible barrier between each other. Although, nothing is ever wrong in design education but they still hesitate probably due to the fear of the consequences and humiliation they may face as the result of incorrect answering.

Design students are required to put in a significant amount of time into their studio classes as forming designs and creating it requires time to do so. A traditional classroom setting makes it hard to collaborate with each other when everyone is focused on completing their task; and consider moving to others for communication as an extra effort as they have to leave their stations to do so. Therefore, the environment of the design studio lacks knowledge-sharing and participation aspect of learning, thus, effecting the creativity one can achieve through it.

Within the context for design education, creativity is the word used for defining projects that fulfill the objectives of the task while being original, reverent and even unique to the creator. Creativity is not born out of thin air nor is it an idea that pops out of nowhere, but rather it is when research is conducted to examine past ideas and work and forming new connection with new projects to achieve the desired outcome/solutions [5].

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### *C. Interior Design Model Concept – “Connect”*

Within the dictionary, the word connect has been defined as to join, and to relate which further explains that how multiple factors are coming together to create one thing. In addition, the connection that has been identified within the following key words influence the design school output.

#### *1) Brain to Person:*

The brain is a complex human organ that controls the body and the place where all the mental processes are taking place. Moreover, it is the control tower of the body that processes and evaluates the perceived information collected through our sensory organs. The Person is the host of the brain and behaves or reacts in the manner the brain has concluded to do so. The brain is also responsible for learning and generating work based on those learnings.

#### *2) Person to People:*

Communication is what connects us to others. It opens up the sociological dimension of life. It allows us to rely what we have come to know and feel about it. When working on a project, the person is limited to the perception it formed regarding a project, therefore when we consult and talk to others regarding it, their experiences and culture influences enable us to open up possibilities that we may not have think otherwise. Learning space is one of the best places to connect and communicate with people from diverse regions which help us unlock and expand our creativity. Moreover, people learn on how to accept criticism and take positive measures to produce the best possible work.

#### *3) People to Environment to Brain:*

People tend to spend their time in different environments such as their home, work, school etc. Each of these places carry a unique environment that instructs the brain to behave in a certain manner accordingly.

To be brief, everything is intricately linked to one another. On the basis of this chain of connection we are going to design our education center of design that not only promotes creativity, productivity and communication between the students; but also enable them to elevate their learning experience and outcome in school. This is vital because design learning is being treated the same as regular education. Although the requirement of

the furniture is fulfilled yet the environmental factors such as psychological and sociological factors have been ignored. This negatively impacts the quality of the work produced by the students as their motivation and competitiveness has been declined.

## II. Literature Review

There have been many studies conducted that connects the features of the interior space to the nature of response and behavior that can occur or become an influencing factor on the population that occupies or uses that space for extended amount of time. The purpose of analyzing literary work was to find evidences regarding which interior characteristics are associated to that of a creative environment and a collaborative space, to ensure that the campus we are designing for design students is an active member of the learning space. Learning is an important part of life which takes up majority of the early years of a person. This is why it is vital that the spaces meant for learning are designed in such a way that it has a positive impact on students.

### A. *The Connection to Environment*

A research was published in the Creativity Research Journal [6] which experimented that whether the environment of the students/people has a role in the creative output. This experiment was conducted within two phases. The first phase contained a set of pictures which were evaluated by independent raters. The aim was to identify the spaces through photographs in which the raters would feel creative. Furthermore, they will not be based upon the interior design elements in this case. The elements such as spatial organization, size of room, shapes, lights and materials. A checklist was created by examining prior work done in relations to creativity. These following identities were listed as the criteria to determine a creative environment provided to the students in the classrooms:

- Freedom

It is something that is a part of personality of creative thinkers, where they are not bound by the existing rules and are flexible in there thought process, hence the environment needs to be able to support the behavior that does not wish to be restricted.

- Challenge

People become engrossed in their task when they come across challenging factors that require them to explore rather than looking at a



single answer. In spaces, challenge is referring to way finding and exploring what the environment has to offer. The more complex it is the more challenging it is.

- Nature

Nature has been a go to place for humans when they wish to relax and be free from the confines of the inbuilt environment and can present many inspirations for creative work.

- Support

When presented with an activity, the basic requirement is to have a proper space that fulfills the physical and psychological needs of the task at hand.

- Coherence

The spaces which are clear about their use and the type of behavior that occurs within that space.

- Threatening

When the environment contains design elements that induces stress and make the space feels less functional.

- Status quo

Controlled spaces that make the user feel confined and restricted to the expected behavior in that area. They do not offer any flexibility.

The results of phase one concluded five independent characteristics of environment to be a contributing factor to creativity:

- ✓ The view of elements of nature
- ✓ Materials that were formed from natural resources
- ✓ Less cool tone colors
- ✓ Design that allows social communication
- ✓ The visual details that the spaces have to offer

Phase 2 of the experiment conducted a creative performance test in 2 different environmental settings. One of which was predicted to be higher in creative output by the raters which were present in phase 1 of the experiment. The results of that experiment supported the predications of the raters. The participants of the experiment were college students.

The factors that could vary the obtained results of the tested theories would be the fact, that the phase 1 was experimented by the use of

photographs, in which the rater can only see what the image shows and not what surrounds it or what the entirety of the space consists of. Moreover, external factors such as temperature, noise levels and the scent of the room could not be taken into account during formation of hypothesis on the elements of environment that could have an impact on creativity.

This experiment although faced with its own limitations was able to prove that the environment does potentially play a role within the creative process of the users. Although their personalities also factor into the whole equation, and are able to determine possible factors which come into play within the spaces which evoke creativity [7].

One of the elements of design mentioned in the above study was the use of natural materials within interior design concluded in its first phase. An article describes the results of a research they conducted in order to know whether the rooms with wooden elements would have an effect on the cognitive performance of office workers. The reason for considering a research on office workers is because university students are learning practical skills that workers in industry are already working on, they both require cognitive functions and focus to work on the tasks they've been given. The experiment consisted of four rooms, a room that had walls, ceiling and floor of white concrete only, 2 rooms had wood replace the concrete in all areas (one had dark wood only and the other has light color wood) and the last room was half white concrete and the other half was of light wood, the room shared a similarity with Japanese aesthetic. The variables of each of the rooms were kept constant as to conduct a fair test in each room. Furthermore, the layout of the room, the furniture, light and even the time of the day it was conducted on were kept constant. All 20 participants spent an hour within that room, attempting the neurobehavioral tests given to them. Each of the participants were questioned regarding their attentions levels and feeling of productivity in each room. Their subjective answers lead to the conclusion that 60% of them considered the concrete room to be the least ideal space. The rooms with wooden elements, according to the participants, allowed them to focus well and feel more productive as compared to the concrete room. The systematic data collected showed that participants doing tasks with wooden room completed them relatively faster and had more correct answers; the type of wood had no special impact on the outcomes.

This experiment as a whole proved to be a positive stimulus for the people and their cognitive outputs [8]. Light is one of the most important and fundamental factors within the physical design of interior spaces as it can impact the user's mental and physical health [9]. Such an element can influence the performance and productivity of the users. Physical aspect of it is the visibility of the materials the students are working on. Besides an inappropriate lighting can cause strain on the eyes and also cause headaches, as well as cause the feeling of sleepiness. This can in turn lead to the mental discomfort and inability to focus on the given activity\_ due to these reasons the performance and productivity become at risk of being affected. A survey conducted in Jordan involved members of the Design and Architecture Association as well as people within the similar career answered the question regarding the importance of lighting within design-studios as very important (26 out of 86 members). Lighting is not just one type, but in interior design, designers utilize natural light and artificial light. The sources can be manipulated by the sources of light for example the size of the window, the intensity and temperature of the artificial light as well as the furniture finishing's, on which the reflection of the light depends on. The role of lighting in interior design extends beyond just for visual tasks because students require light to be able to move around in campus, eat, socialize, taken in the aesthetics offered by their surroundings and feel safe.

Although it is clear that natural light is beneficial to the population of those in interior areas where people spend long hours of the day. The current study aims to answer is the question that the people who occupy certain rooms on occasional basis or shorter terms, whether they experience any difference in performance for the short time they do not receive natural light? The experiment was carried out through the time span of six years, on 278 students studying architecture in university, age range being 22 to about 27 years. Moreover, three types of classrooms were used as the host for the experiment and the subject taught in all these classes was the same. Each term the location the classroom would change. The classes used were situated in basement, classroom with regular windows (having curtains) and a classroom with clerestory windows. The theoretical subject was about an hour and fifteen minutes long, once a week for 16 weeks. Data was collected from each term of the student performance (exam score) and attendance. Although the attendance difference between the groups window classrooms and basement classroom was not significantly great, the exam scores showed that the students who studied within classrooms with window

performed better when compared to their peers who studied in basement classrooms. The results proved that natural light contributes to how well of an impact it has on the psychological capabilities of the students. Another thing to note down from this experiment was also the fact that an analysis of class strength was also tested against exam scores. The years in which had low rate of student population, enrolled within that class, did perform better than the years in which more student bodies were counted.

The above literature provides an evidence that nature is a restorative element, which bring its benefits to the people when present within that space. Furthermore, this also stands true for students within the learning environment, therefore it becomes a rather positive stimulus. The students who are studying in university are an easy target to stress and other psychological pressures because of the competition and expectations of the people around them. This study aims to improve the quality of the environment by including elements of natural environment into the overall campus design. In this way, it becomes an invisible helping hand for the students to achieve their goals of learning and performing well in their studies. The positive effects of the elements of nature extend to natural lighting as well. This dimension of approach is not just for the students but rather for the staff that is present within the institute as well, as they have to teach numerous classes throughout the day, hence these features will bring wellness to their environment as well.

### *B. Connect to People: Communication and Collaboration*

According to the current study, the interactions that occur within the space of a university/educational areas are of two types, namely, between teacher to student interaction and student to student interaction. The current study defines Communication as a process of sharing knowledge and thoughts to a person or people. It allows students to be able to put forth their ideas; positively accept criticism; and share/receive opinions. It enables the students to gather their thoughts and commute them in a manner that can be comprehended by all. It could also be a source to improve their language skills in the process of communication. As design students, it is often required to present your work to your teachers as well as jurors and justify why you have made certain decisions, therefore clarity becomes a necessity. Regular interactions with instructors and friends allow them to develop their skills. An interview conducted with a student during a study highlighted that

students often visit their peers or seniors in design schools for feedback and to progress their design further.

Collaboration occurs when students or workers come together to work on a project with a common goal. Collaboration makes problems-solving easier and efficient rather than working alone [10]. A university campus is often composed of both formal and informal learning space and having a common area where students of different semesters can come together to form a positive environment and creates chances for the juniors to interact with their seniors for guidance.

Design Studios require a layout that will support communications; nonetheless, students require individual work stations as well so that independent projects can be tackled. Just like communication, being focused and attentive to your own work is also a huge part of learning. Hence, a personal station is equally essential as well. The core concept of the ideas being formed are ultimately the product of one's own mind; sharing with others can enable students to further development and receive feedback on it. To reach that core (initial stage) students may require their own space to be able to think about the solution to the given task. An article compared two first year design studio classes layout and surveyed the students for their opinion regarding it [11].

These studios belong to Universiti Teknologi Malaysia (UTM) and National University of Singapore (NUS). From the comparison, it can be concluded that students of each year have been assigned a specific studio classroom of their campus at both universities. The design studio at NUS for 1<sup>st</sup> year students seems suited for an informal learning space rather than a formal study space. From the student feedback it can be seen that majority of the students at both UTM and NUS prefer to have a more personal work station rather than sharing one station with other students and focus on their own work. For interaction between peers, they tend to opt for spaces that are meant for interaction, in other words they would like to keep their work separate from discussions and have a separate discussion area. Out of the two universities UTM satisfies what the students wish for within their learning spaces.

All the aforementioned findings of the literature are projecting towards making the design of the campus stimulating for the students. The current research proved that the elements that are present in the environment, are in

some way being processed by brain, as our sensory organs are always in action. Although, the impact is not realized on a conscious level yet it does not mean that it is not there. For example, it is common knowledge that light is required to have proper visuals in order to carry out an activity, but it is uncommon to know that nature can indeed impact the performance of the students. The design world is now going beyond the level of mere functionality and aesthetics. It is rather considering what psychological advantages the design will incorporate because the world is already spending 90% of their time indoors which is in itself not healthy for our mental or physical growth. Therefore, it is important those elements from the nature are brought to the people in doors.

### **III. Proposed Design Development**

The major aspect of this project is to analyze the influence of interior design on behavior and the sub-conscious of the users present within bounds of a space. Color as an element of design, is the most known, as compared to other elements, in terms of having an impact on the emotions of humans when exposed to them. With the conducted case study, association between learning performances, creativity as well as communication to interior design was formed as the result of studies done by researchers and groups to improve the conditions of learning spaces and enhance positive outcomes. The outlined elements such as natural light and representation of or exposure to natural views and materials having an influence on the performance in learning is not something, which is normally considered when institutions are being established/planned. The understanding gained from the literature review [12] will therefore help in shaping the design of the interior space. The main factors that make up this institute is the utilization of both formal and informal learning spaces.

The theme and the concept of the interior of the institute is inspired from parametric design. Common characteristics of the design include repetition and a sense of movement. The design is derived in a philosophical way. The deformation of the geometric shapes, represents a break out from the mold create in earlier education. Creativity requires students to break free from the limits that have been defined and aim to achieve something unique.

The color scheme is mostly of primary colors; red, yellow and blue. It also contains oranges and some green accents. Each color has their own impact on people. The primary colors are used metaphorically because these

are foundation of all others colors formed and students come to learn the foundations and then grow further using those foundations.

The overall design approach of the space planning is to promote the social zones. Leading from highly social zones to lower, as in where the chance of meeting new people is higher and where it is lower. These classrooms cover all necessary spaces needed for students who are studying design. The offices could be made to be non-cabin as this type of style arrangement will allow more collaborative work between the lecturers. This can help broadens the vision of the course and give students better quality of education.

#### **IV. General Features of the Interior Design Model**

This study designs each classroom in such a way that it has an access to natural light. In this way, students can view outside the classroom easily to get absorb outside environment. Thus, they are not being completely boxed in by course content. The visible landscape keeps them in touch with the benefits of nature. Each class utilizes the material wood as the element of nature within indoors to stimulate the brain process and benefit from it [13]. Desk surface and writing pads of the chairs have wooden texture for the addition natural material. The desk uses wooden textured tabletops. The chairs are moveable for collaboration with surrounding students so that the creative and learning process made enjoyable. The furniture arrangement is for students facing each other. The chairs have the ability to rotate so that when the teacher is teaching, they can easily face them. This arrangement is beneficial in the way that the teacher can easily get to each student without creating and facing any discomfort. The art room contains a corkboard between window spaces as well, because each student will have their own way to representing how they view the world. Hence, there will be more to display. The reason why radical arrangement furniture works the best is the again all the see the same subject but draw it how they view it [14]. The walls in these rooms are writable and the end of both these classes have corkboards for displaying along with front of the class. Drafting studios have adjustable tables making them more versatile in use.

In addition to the usual learning spaces within an art institution, there is a provision for a collaborative space. This lounge area has a variety of sitting spaces. Casual sitting, high table tops, and regular table chairs. This

makes the space multifunctional, suitable for working, meeting new students, casual chitchat and as well as group work. The design main feature of the lounge sitting is the feature wall. The feature wall has parametric pattern filled with color. This pattern is widely known as Voronoi pattern that also fits into the parametric design [15]. The pattern gives off the feel that shapes like hexagons were deformed to achieve such a pattern. Making a literal statement about how to achieve creativity to students need to break the boundaries. The ceiling of the area also exhibits parametric design giving dimension and interest. The partition within the hallways created by plantation, giving calm impact of nature on the mind and soul of the one sitting in the surrounding.

The exhibition display walls have been positioned in a way that reminds of the maze. It has been arranged in that way as to influence the circulation path of the student or visitor. This can lead to competitiveness, motivation and inspiration.

## V. Conclusion

The current study concludes that learning through creativity plays an essential role in imparting design skills to learners. The learning process in this field is entirely different from primary and secondary education techniques. The research analyzed that the students face challenges in the formation of ideas, brainstorming and being creative without the adequate learning environment for art and design institutions. The main essence of the proposed project is to support the creative environment in the learning centers. The key player to help in this goal was space planning for mutual collaboration to achieve enhanced cognitive and sensory experience in students. The arrangement also supports peer-to-peer communication. This project utilizes effective space planning and appropriate materials for interior design to reach the desired objective.

In addition, the project emphasizes the roll of interior design elements that can have an influence on the sub-conscious state of the student. By reviewing previously done studies, the enhanced learning through cognitive factors is established. Hence, a Sensory-Cognitive interior design model for improved learning outcomes in art and design institutions has been effectively presented for future considerations.



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