Architectural Students' Learning Styles and Their Urgent Need for An Inspiring Space

Fatima A. Hosny[1, a, *], Mona H. Soliman[2, b], and Mamdouh A. Farag[3, c]

[1] Demonstrator at the Department of Architecture, Faculty of Engineering, Fayoum University

[2] Professor of Architecture and Architectural Design at the Department of Architecture, Faculty of Engineering, Fayoum University

[3] Lecturer at the Department of Architecture, Faculty of Engineering, Fayoum University

E-mail: [a, *] fah11@fayoum.edu.eg (Corresponding author),
[b]mhs00@fayoum.edu.eg, [c]maf00@fayoum.edu.eg

Abstract

Space is the most effective tool to inspire architectural students. Architectural thinking usually uses a standard space prototype, giving no respect for students` learning styles. The scope has covered a deductive framework within a survey that started with a learning styles questionnaire and ended with an applicable descriptive study with a sample of architectural students to frame their environmental preferences according to their learning style. The methodology utilized multiple data accumulations as questionnaires, interviewing participants individually and noting their descriptions of their favorite inspiring spaces. Afterward, the data investigation was designated using Statistical Analysis Software (SAS) for data analysis and the Midjourney AI server in the text-to-image generation stage. The initial results showed how much architectural students prefer the reflector learning style. Although participants are different in gender and locality distribution, most showed a clear tendency to the inspiring personal space. Remarkably, the intermission space showed a higher preference frequency than the presentation space, which reflects the self-motivated nature of inspiration. In contrast, all participants showed little interest in inspiring collaboration or making spaces. Consequently, the analysis concluded a descriptive study minding the characteristics of different categories of personal spaces described by architectural

168

students considering their learning style preferences. Each learning style reveals particular environmental needs in the preferred inspiring space, setting preliminary design criteria for a satisfying design studio containing different learning styles.

Keywords: Architectural students; inspiring space; learning styles; creative architectural learning; idea generation

169

1. Introduction

Students of architecture are unique people with a variety of demands that are influenced by their inspirations and intuitions. Unlike other college students, they pay close attention to every little thing around them. They can spend a lot of time there thinking, writing, talking, and mingling, and it has a hallowed atmosphere for them [1]. After spending time in such a space, they tend to add their characters by adding new features or changing their arrangement to a permanent space. Once they build a relationship with the space, it becomes a personal creative space for each of them. From this observation, several scholars have described the connection between architectural students and spaces referred to as personal spaces, where each student finds the settings that meet his needs [2]. Although architecture education is associated with studying different disciplines, from the human sciences to design creativity, design creativity plays a significant role in the architectural curriculum. In this context, architectural students usually get pressured to guarantee new ideas and get innovative design concepts, urging them to find the perfect space for inspiration. The nature of architectural students` needs settles architectural learning from the conventional theories [3], to the theory of experiential learning and the focus on reflecting knowledge as well as acquiring it [4]. According to this arrangement, selecting a preferred space to think deeply about architectural design counts on students` perspectives and their recognition of a comfort zone satisfying their psychological needs. The selected space reflects students` sense of space, preferred privacy regulation, and territory level during architectural creative thinking. Between solitude, anonymity, reserve, friendship, and intimacy, architectural students find their suitable case to get into the mood for creative thinking and be ready to solve design problems without feeling lonely or interrupted [2]. Besides, each student builds his/her relationships with the inspiring space in a specific territory level, either primary, secondary, or public territory [5]. Since the inclining of selecting a primary territory level as a personal space is a part of human nature, students, most of the time, don`t get to determine their territory level. Nevertheless, they choose their privacy level, assuming that spending time occupying the space with architectural activities is their aura built with their psychological barriers [6].

1.1. Theory of experiential learning

The experiential theory is about the learning preferences of individuals and how students acquire knowledge and transform it in different ways. The first attempt to raise the theory was in 1984 by David Kolb, right after the "theory of experience" discussed by Dewey in 1983 and adopted the role of social relationships in the constructivist learning [7]. The theory declares two different notions of acquiring knowledge, concrete experience (CE) and abstract conceptualization (AC), as well as two moods of transforming this knowledge, active experimentation (AE) and reflective observation (RO). The whole process can be described in a longitudinal balance, as in Figure 1, between acquiring and transforming, where each quadrant defines a specific learning style. Acquiring knowledge in a concrete experience (CE) mood, living the scenario with full emotional involvement, and changing it into a reflective observation (RO) mood, resulting in a general self-perspective or comprehensive comprehension, results in the Diverging learning style [8]. While in the

active experimentation (AE) mood, focused on the practical application of ideas, (CE) develops an Accommodating learning style. Furthermore, the use of the abstract conceptualization (AC) mood, the interest in examining theories and identifying the logic of each item of information, in acquiring knowledge with (RO) or (AE) in converting it leads to either the Assimilating or Converging learning styles in succession. The studies showed that although the learning moods organize a learning cycle, a student cannot experience more than one dominant learning style in one situation according to his/her unconscious mood preference in both stages of the experiential learning [9].
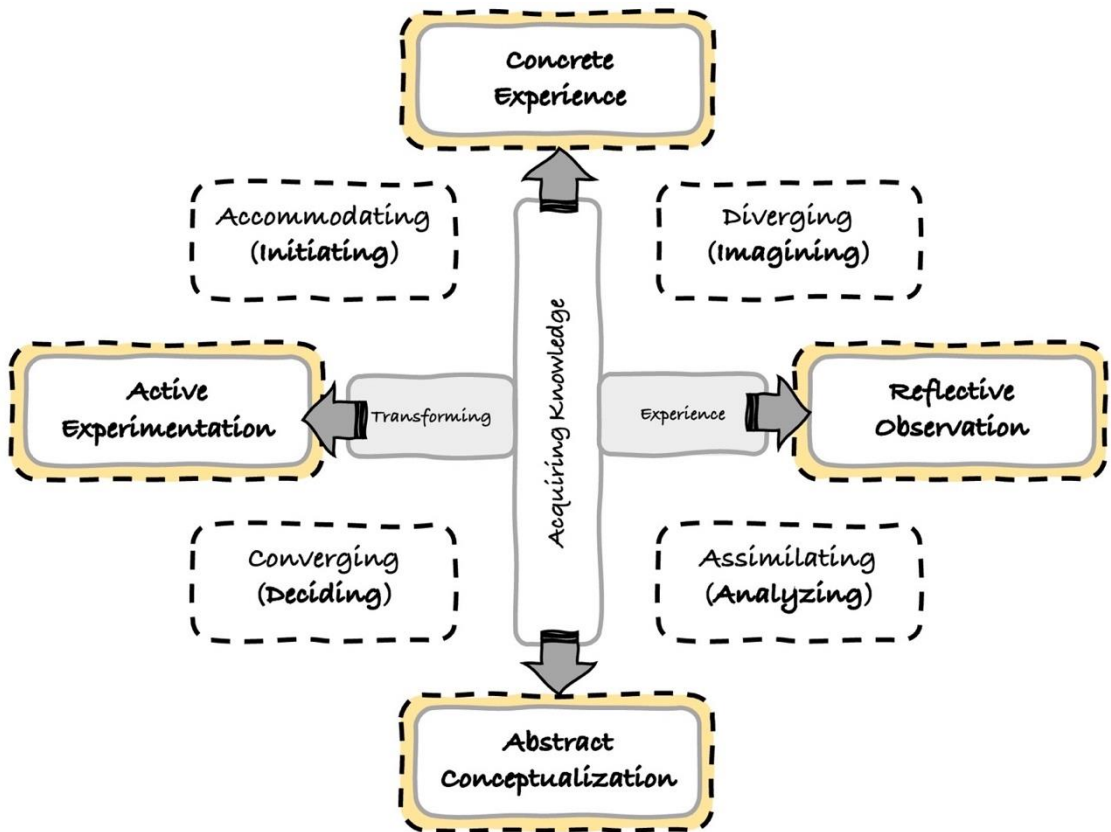

Figure 1. The learning cycle of experiential learning theory [Authors]

Students with a (1) Diverging learning style are those that use their emotional and impulsive reactions to assimilate knowledge and integrate with social experiences, then translate these emotional insights into holistic perspectives and broad theories. Those who prefer (2) the Converging learning style, on the other hand, use analytical methods to separate their comprehension of theories (pure knowledge) from practical practice. In comparison, students with a (3) Assimilating style are analytical thinkers with strong verbal and persuasive abilities. Students of (4) Accommodating learning style are people who enjoy doing practical work and having an emotional experience. As Table 1 describes,

several differences distinguish each learning style. As each style adopts a particular path in learning by imagining, analyzing, deciding, or initiating, as a distinction in one or two design stages, observing, brainstorming, research, hands-on, discussions, modeling, and final evaluation [10].

1.2. Inspiring space

Architecture education is a process of experiential learning with complicated interactive affairs almost happens at the same time [1]. More importantly, architectural students continually seek inspiration to enhance their design thinking. Getting inspired through idea generation is one of the most crucial steps in architectural learning as students create their inspiration techniques according to their cultures, opportunities, and learning style. Several studies have been conducted to declare inspiring strategies for teaching and developing regenerative pedagogy for better productivity [10]. However, only a few studies uncovered the environmental preferences of architectural students that influence idea generation according to their independent learning styles.

Table 1. Features of architectural students' learning styles [Authors]

	Diverging (Reflergers)	Assimilating (Theorists)	Converging (Pragmatists)	Accommodating (Activists)
Abilities	• Imagining capabilities • Social interactions • Successful peer learning • Generation of new ideas	• Organizing information • Analytical thinking • Planning to build theories • Creating new theories	• Problem-solving • Efficiency of making a decision • Practical thinking • Applicable solutions	• Flexible movement • Influencing others • Observing opportunities • Utilizing social relationships
Limits	• Inability to reaching practical solutions • Random thoughts • Wasting most time in initial stages	• Giving short time for imagination • Losing communication with others • Traditional systematic solutions	• Discomfort with puzzled takes • Unsuccessful peer learning experience • Getting under the pressure of	• Pushy • Impulsive reactions

			losing concentration or being late	
Strengths	• Feeling of belonging and self-awareness • Seeking for a better future • Positivity and helping others • Being comfortable with ambiguity	• Planning for future • Calculations for expected mistakes • Effective role in studio crits • Concerning with details in analyzing	• Rich technical interpretation • Well-use of time management • Improving performance by practical solutions	• Acting on intuitions • Using social relationships as a learning mean • Experiment solutions by trying • Taking hold of opportunities
Practice	Measuring possibilities through brainstorming, and concerning with empathy and feelings	Collecting information before making any decision, and organizing inputs to create plans	Starting from a small point to reach goals, frequent process assessments, and using reminder notes to justify making decisions	Changing inputs in each trail to build experience, searching for opportunities, and sharing outputs with others
Teamwork	• Sharing opinions and involving with others • Asking questions • Listening and learning from others	• Evaluating and creating opinions on others work • Discussing details and searching for reasons • Forming conceptual theories	• Commitment to plans • Measuring outcomes of the group • Direct individual solutions	• Encouraging others and making connections • Getting things done shortly

173

Key phrases	• "what if we imagine that?" • "let`s share work." • "I can help make it possible."	• "I`ve noticed some issues."    • "Can you explain?"    • "I think it`s not realistic."	• "Go for this option." • "we have to submit on time" • "these are my design aims."	• "I`ve already did that." • "I sense this is correct." • "I need more time to get it done"
Fear	Making a decision	Spontaneity	Discussion	Present circumstances

In a study conducted at Alexandria University, scholars managed to relate students' personalities with their creativity levels using the Myers-Briggs Type Indicator to differentiate students' personalities and the Consensual Assessment Technique to evaluate students' creativity levels. The results strongly correlate architectural students' creative work and their personalities [11]. Others have used a design practice to prove the connection between students` learning styles and design capabilities. Thus, each group of learners focuses on specific design aspects to use their learning style advantages and improve their performance disadvantages. Consequently, the study focuses on the architectural students' preferences for an inspiring space. Named Inspiration Space, the study identifies the term as a supportive environment for creative thinking in architectural design problems [12]. Creativity creates original ideas and solutions concerning self-desires and cultural background [13, 14]. The study seeks to distinguish students' preferences for creative environment setting according to their learning styles. Instead of restricting creative environments and inspiring spaces to design studios, the authors suggested a more liberated approach to concluding architectural students' needs to feel inspired. Thus, the study presents a general perspective for inspiring space needs and investigates a set of particular facilities to stimulate dormant thoughts and give a student the experience of seeing things differently or creating a new world [15, 16]. Therefore, the inspiring environment could be anywhere students experience creativity and comfort in architectural design thinking.

The classification of inspiring space categorizes into five types of spaces marked by the nature of the space, the design settings, the embedded activities, and the number of users. Thus, each space type represents specific qualities and moods for its users [17]. Thus, each space type represents specific qualities and moods for its users. These types are identified as the following:

- *Personal Space*: the possibilities of concentration without interruptions and feeling inspired by having a private bubble filled with calmness and tidiness [2].
- *Collaboration Space*: the power of social interactions and brainstorming in idea generation and influencing others` thoughts within the formal and informal discussions.
- *Presentation Space*: reacting to motivating presentations and exhibitions while passively acquiring knowledge.
- *Making Space*: inspiration through active interactions in workspaces and participation in practical integration with the environment.
- *Intermission Space*: the spare spaces between other types or used as a pause area like cafeterias, lobbies, stairs, restrooms, and outdoor areas.

As shown in Figure 2, each of the five types possesses specific qualifications for being inspiring. Personal space selection, a simulation of a sacred monastery where a student can think alone in individual concept generation and deduce the results of the study within a silent atmosphere, can affect architectural students in terms of creativity and inspiration by having (1) an open view, (2) visual stimuli of design elements, or (3) reduced stimulation by being empty. Its examples could be a home, a library, a private office, or a specific spot in a garden.

On the contrary, a collaboration space which is a welcoming environment with colleagues, neighbors, or family members sharing the same cooperative atmosphere with conversations and noise, can influence students by implementing (1) social interactions, (2) tactile, acoustic, and olfactory stimuli, or (3) bodily movement activities [14]. These settings encourage their interactive participation in the brainstorming process without experiencing anxiety and reflect the environmental experience in a creative notion. Presentation space, filled with new visions or artworks, triggers inspiration through (1) motivation chaos or (2) visual stimuli. While making space that architectural students use for modeling with different techniques allows for several creativity propositions like (1) creating an experimental environment, (2) bodily movement activities, (3) open view in the case of outdoor workspaces, (4) social interactions, (5) motivating chaos, or (6) tactile, acoustic, and olfactory stimuli. Also, intermission space which is usually a common inspiring space between art students allows an unexpected status of focusing through offering one of these propositions, (1) bodily movement activities, (2) open view in case of transportation or outdoor stairs, or (3) surprise [18].
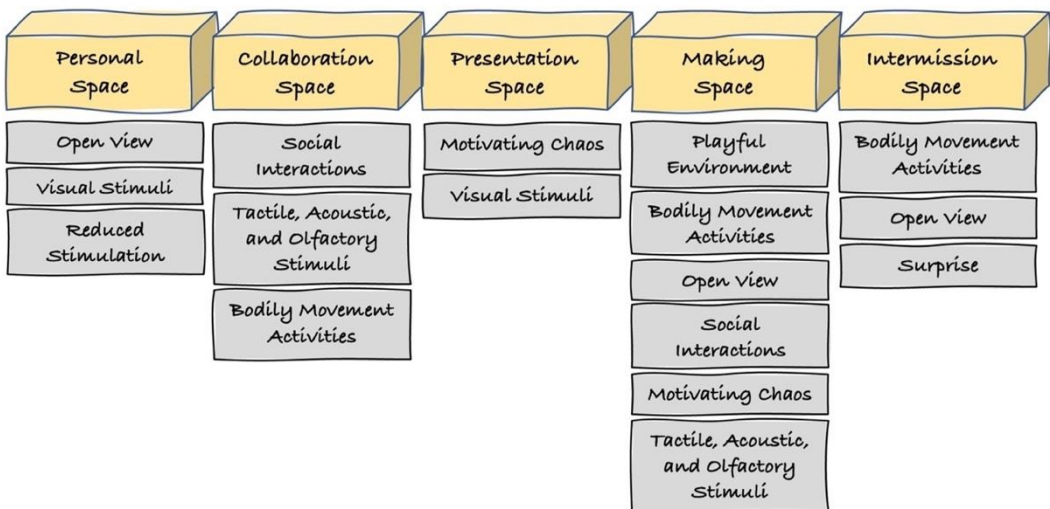
1.3. Inspiring space

Architectural thinking is often related to the idea or concept generation. Although architectural students spend most of their time analyzing and evaluating models to develop functionality and preciseness, giving little space for imagination, they often consider creating new concepts to propose an innovative project. The demand for creative architectural work has recently increased to meet the economic development and human prosperity needs due to globalization. Thus, after the research phase, architectural students cultivate the idea generation phase in the initial design stages and then implement the idea in design solutions before evaluating the entire output [17]. In a study conducted in Turkey at

Middle East Technical University at the Department of Industrial Design, the results concluded four different styles of idea generation. These styles differentiate idea generators (students) into four groups, the independent idea generators, the collaborative idea generators, the over-sensitive idea generators, and the effective idea generators [19].

- *Independent idea generators*: students who are goal-oriented and find it simple to commence conceptual thinking. Furthermore, they make no use of collaborative effort or the ideas of others.
- *Collaborative idea generators*: students with a tendency to respond to others' work, collect others' ideas to create new ideas, and care for what people think in their work.
- *Over-sensitive idea generators:* students who find it challenging to initiate creating ideas or following a strategy to accomplish something. They are the most cooperative people and care for the performance of their peers and the following strategies to get things done.
- *effective idea generators:* the quick learners who use the dynamic of practice for inspiration. They are talented in presenting ideas and using strategies to create diverse ideas.

However, all idea generators count on two methods, visual and mental techniques. Imagination in architectural education is accumulating knowledge and memories to create new valuable ideas or visual images [20]. At the same time, visual techniques are about sketching, collage, or 3D modeling. While mental techniques cover using brainstorming, mind maps, and checklists to create ideas and cultivate imagination. In the process of generating imaginative ideas, architectural students go through four steps preparation and then incubation for the collected knowledge with experiences and memories to reach

illumination with several ideas to solve design problems, and finally, evaluating the solutions in the verification step [21].

Figure 2. Qualifications propositions of inspiring spaces [Authors]

	Skeptical Nature matches **Theorists**	**Willingness to Initiate** matches **Activists**	**Flexible Attitude** matches **Reflectors**	**Self-Criticism** matches **Pragmatists**
Pros	• Decisions are taken based on something • Avoiding impulsiveness • High observatory skills • Analytical vision • Questioning everything	• Feeling of excitement • Quick understanding for the approach • Flexibility of approaching idea generation steps	• Detailed solutions • Open minded fixation of ideas • Relating things to the surroundings • Organized thinking • Eye-opining experience of reflection	• Observation skills • Critical thinking • Evaluating solutions constantly • Finding design problems
Cons	• Taking too much time before making decisions • Having doubts about each step • Moving backwards	• Having difficulties to find solutions • Putting too much effort in failed trials • Inability to focus on the purpose of the idea	• Difficulties of taking the first step • Clinging to one idea • Dividing design idea into several attributes	• Avoiding others • Low self-confidence • Clinging to one point of view

Table 2. Idea generation themes of architectural students [22]

According to a study conducted in the Arab Academy for Science, Technology and Maritime Transport in Cairo, Egypt (AASTMT), the analytical study for idea generation themes showed that students followed five main themes, Skeptical Nature, Willingness to Initiate, Flexible Attitude, Generative Behavior, and Self-Criticism [22]. The analysis of the keywords and sub-themes of each main theme gives the impression that Generative Behavior is an ideal theme though all students seek to reach it by trying to verify solutions and present different unique ideas. While each of the rest themes is describing the diversity

177

of idea-generation techniques with different pros and cons as shown in Table 2 Thus, this analysis coincides with the analysis of learning style characteristics in Table 1.

2. Problem Statement

The deductive study of linking architectural students' learning styles and their preferred inspiring space tries to answer the following questions:

- How can a student`s learning style influence his selection of a specific inspiring space?
- What is the connection between students` learning styles and their idea-generation techniques?
- Are there any significant differences in the selected inspiring space of architectural students across gender and locality?
- What are the mutual similarities between different learning styles in describing their avoided space?

3. Research Objective

The methodology of the study aims to develop design criteria for different types of inspiring spaces for architectural students according to their learning styles with a full understanding of students' different environmental needs.

4. Research Methodology

4.1. Data collection

Relating architectural students` learning styles with their affinity to select their inspiring space required applying qualitative and quantitative study. The quantitative study was conducted by applying two questionnaire surveys. As a result of the absence of a specialized learning styles questionnaire for architectural students, the first survey implemented Kolb`s learning styles questionnaire 3.1 version of 2005 [7], revised by Peter Honey and Alan Mumford [11], to identify the individual preferences of learning styles. According to Kolb, students use four main learning styles as mentioned previously, diverging (Reflector), assimilating (Theorist), converging (Pragmatist), and accommodating (Activist). Thus, during architectural thinking, each learning style embraces his preferred theme of idea generation in his selected space of inspiration. The second survey embraced an independent questionnaire of five issues to declare his/her name, academic level, locality, possible inspiring space which is perfect for idea generation, and avoided space where they expect to find distraction and discomfort. The main considered variables of the study are gender and locality. Although many studies conducted on architectural students discovered that there are no significant differences between students in imaginative skills or creative thinking abilities based on gender [23]. and others found that learning styles distribution

and gender are independent, several scholars correlated gender and architectural students` learning [20]. In this framework, the research includes gender as one of the main study variables to mark a clear result of the differences between male and female students in imagining their inspiring space. Also, locality, differentiated by selecting whether living in a rural, suburban, or urban space, represents the influence of students` background on their imagination and environmental needs. Furthermore, the qualitative study was conducted by interviewing each participant to discuss his/her descriptions of the imaginative inspiring space. Sequentially, a few of them have been chosen to use their descriptions to create images closely present the selected space.

4.2. Sample design

Participants of the survey questionnaires are volunteer architectural students from the four academic levels of the Architecture Engineering Department at Fayoum University. The total publication is 141 students in the department, As shown in Figure 3, 130 students (92%) have volunteered to participate, 36 students from the first academic level, 23 from the second, 35 from the third, and 36 seniors. Both males, 62 students, and females, 68 students, were privately interviewed after submitting the surveys to discuss their answers for imagining both the inspiring and the avoided spaces. The authors utilized recording students' quotes while expressing their needs in their imaginative inspiring space. The majority of students' preferences are expected to be repeated in the case of a written text. However, spontaneous speaking about their spatial preferences can show significant differences while describing the same selection.

4.3. Data analysis

Describing data through frequencies and percentages was illustrated by SAS (Statistical Analysis Software) drive to classify students` learning styles through Kolb`s questionnaire results and their answers to the five questions of the independent questionnaire. Separately, study results adopted a comparative analysis using Needle Plots to find the correlation between study variables. Thus, deciding students` locality distribution, preferences of learning styles, idea generation styles, inspiring space types, and avoided spaces using Single Par Charts is followed by correlating learning styles with locality, idea generation style, idea generation theme, preferred inspiring space, and avoided space to determine the relations between every two variables and how one affects the other. Following the instrumented learning styles questionnaire revised by Peter Honey and Alan Mumford, learning styles preferences are leveled starting from Very Strong towards Low preference. These levels are used with the outputs of students' interviews to determine the idea generation style and theme of each student, confirmed by each student at the end of the interview. Moreover, the analytical study adopted evaluated the influence of the main variables of the study, locality, and gender, on both learning style and inspiring space preferences.

4.4. Instrument

In addition to the printed surveys, ten excited volunteers from the reflector, activist, and theorist learning styles and five pragmatists were asked to turn their descriptive text for their inspiring space into an image by making use of an artificial intelligence image
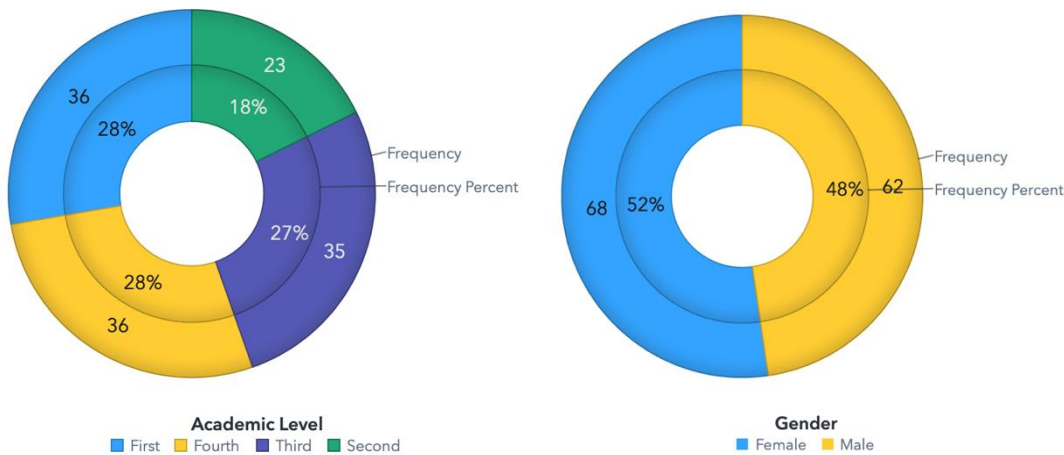
generator tool. They have picked Midjourney prompts to visualize their mind`s images by turning written descriptive text into images. Prompt modifying allowed the development of the descriptive text and the use of deep imagination to improve the output several times till each of the 35 students reached his/her meant inspiring space. Each of them conducted their text-to-image generation during the interview through the Discord application using a conversation with the Midjourney AI server.

Figure 3. Distribution of the sample, (left) differentiating the percentages of males and females, and (right) relating participants to their academic level [Authors via SAS]

5. Ethical Considerations

Surveys, interviews, and text-to-image generation were conducted after getting students' approval to participate in scientific research and announcing their preferences results, and personal information obtained in the independent questionnaire. Besides, the authors tended to individually discuss students' outputs, learning style, idea generation style and theme, inspiring space, and avoided space, to make sure that students take advantage of the study procedure and enhance their identity development.

6. Results and Discussion

The survey results are separated into two quantitative studies. The first study deducted from Kolb's learning style questionnaire indicated, as shown in Figure 4, the high percentage of preferring Reflector learning style (41%) and Activist learning style (32%) which align with the nature of architectural students and their social flexibilities in architecture learning and utilizing of environmental situations in generating new ideas. While the second study used the independent questionnaire and the interview to allow

180

architectural students to express their self-preferences. The third question in the independent questionnaire managed to ask students about their original locality, whether he/she lives in a rural, urban, or suburban area. While fourth and fifth questions requested sequentially describe the most preferred inspiring space and the most avoided space while the idea generation stage in architectural projects. The results of this questionnaire indicated the aforementioned academic level distribution, previously shown in Figure 3. In addition, the results of the third question, as shown in Figure 6, emphasized the high percentage of rural locality students (42%) and the rapprochement of suburban and urban locality students (28%) and (30%) in order. Students' answers to the fourth and fifth questions designated the frequencies of the most inspiring and the most avoided spaces. More than half of the participants, (53%) selected personal space as their most inspiring one. However, their descriptive texts about personal space had distinctive characteristics. They tend to have calmness and privacy within different settings.

The results of the first survey, learning style preference, and the preferred inspiring space illustrated the base for the study of the idea generation style. effective and collaborative idea generation styles are the most preferred among the

Learning Style

Learning Style	Frequency
Reflector	53
Activist	41
Theorist	31
Pragmatist	5
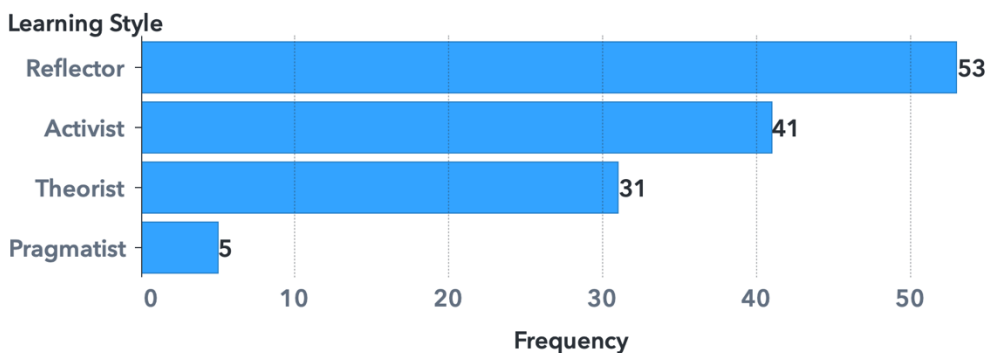
four styles with a frequency percentage of (34%) and (31%) in order. While only (13%) preferred the independent style. Additionally, the study included declaring the avoided space for architectural students. Most students (53%) stated that overcrowded spaces are the most avoided spaces, while few mentioned avoiding being home (4%) during the idea generation stage.

Figure 4. Learning styles distribution of architectural students [Authors via SAS]

The study scope illuminated correlating learning styles with the preference for inspiring space as shown in Figure 5, all learning styles indicated a major preference for personal space except the pragmatist style. All three styles, activist, reflector, and theorist, shared the synthesis of preferring one of the three inspiring space types. Though, pragmatists showed no preference for presentation space. For this reason, the study deduced the following:

Figure 5. The reflection of learning style on selecting inspiring space types [Authors via SAS]
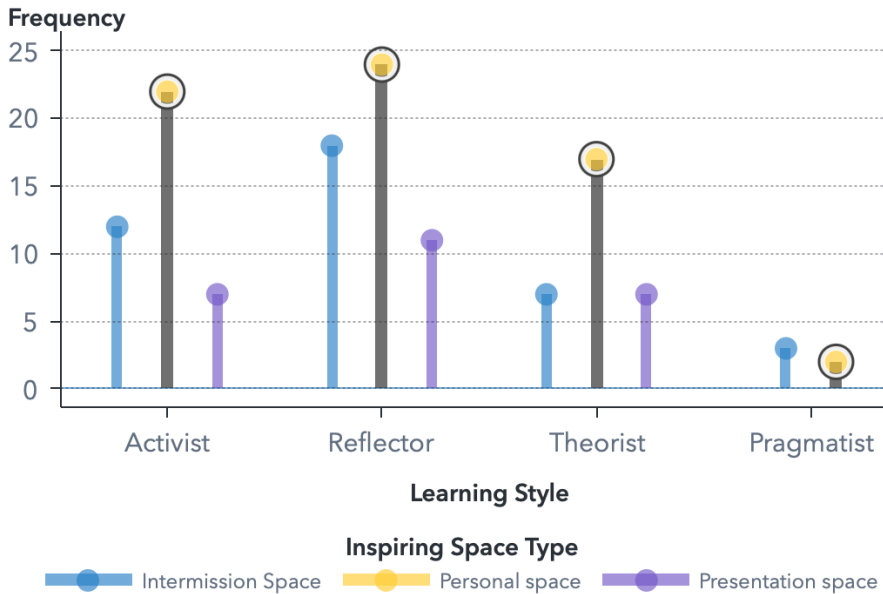
- Architectural students mostly prefer being reflectors or activists during learning architecture with a common inclination to personal space as an inspiring environment.
- On the contrary, presentation space is the less attractive type.

Figure 6. The results of the second study, locality distribution, frequency of avoided spaces, idea generation style preferences, and preferences of inspiring space type [Authors via SAS]

Figure 7. Effects of study variables on selecting inspiring space type, (left) the influence of gender on results, and (right) the impact of locality differences on results [Authors via SAS]

Considering the effects of gender and locality distribution as supposed variables in the study showed hardly noticeable differences as shown in (a) Figure 7. Both males and females have an extensive preference for personal space as an inspiring environment type. However, females showed a higher percentage (54%) of inclination to personal spaces than males (45%) and a lower percentage (15%) of preferring presentation space than males (24%). This marks the minor influence of architectural students` gender in selecting inspiring space types. Equally, locality differences showed the same slight effect on students` preferences of inspiring space type as the analysis (b) indicates that although all students tend to choose
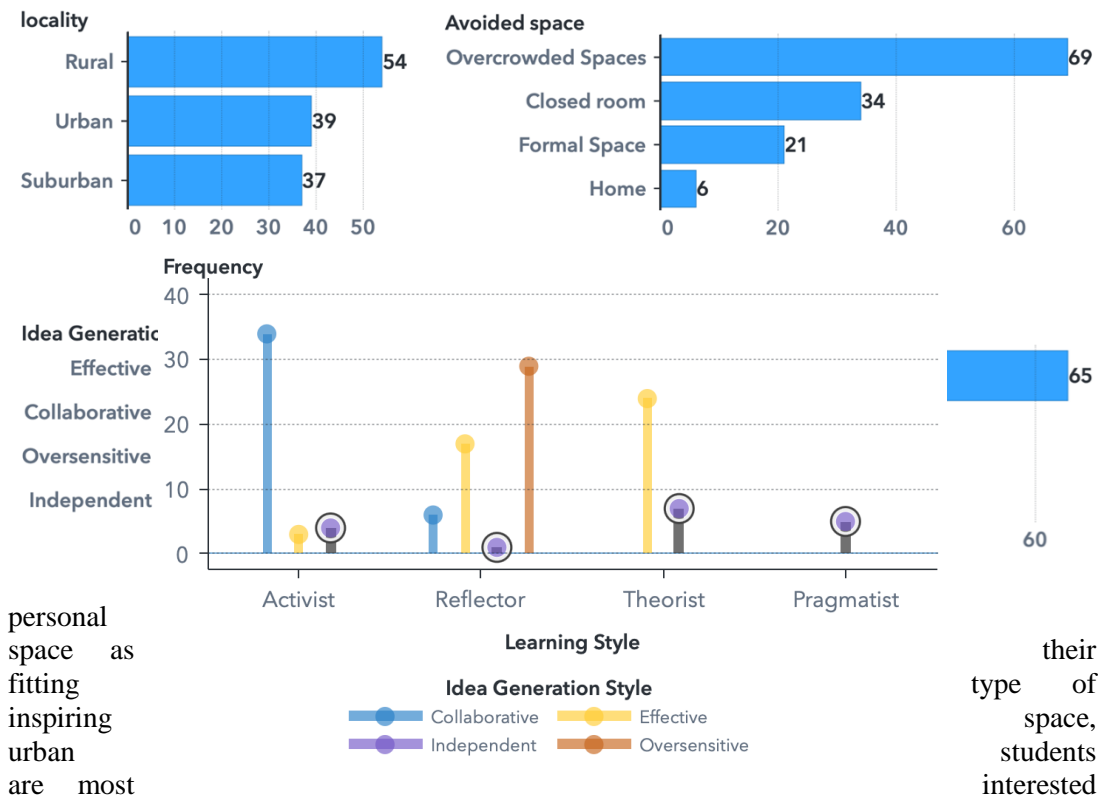
personal space as fitting inspiring urban are most

their type of space, students interested
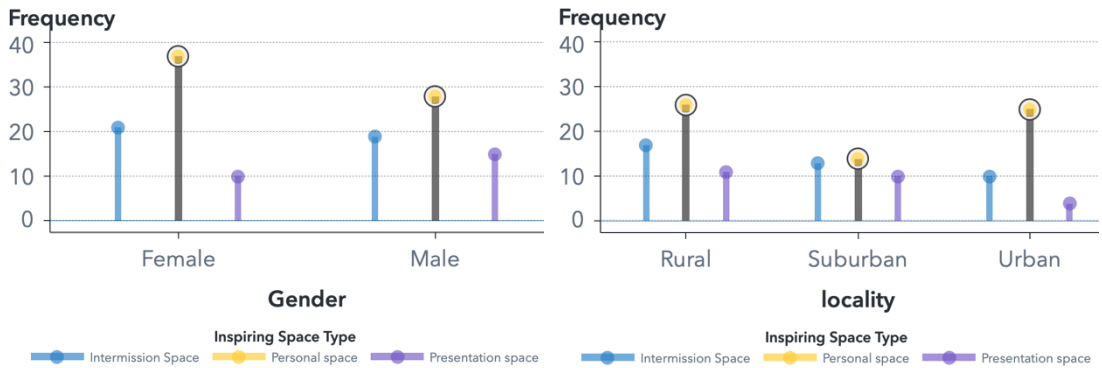
in personal space as (48%) of rural students, (38%) of suburban students, and (64%) of urban students stated their need of personal space to get inspired. In addition, since suburban locality students showed the highest percentage in preferring intermission spaces (35%), urban locality students showed the lowest percentage (26%)

Figure 8. Linking learning style preference with idea generation style [Authors via SAS]

Surprisingly, the study of idea generation style revealed that although the majority of architectural students have a mutual preference for inspiring personal space type, few (17%) showed interest in independent idea generation style as shown in Figure 8. Furthermore, effective and collaborative styles have the most significant preferences with a total of (65%) which settle the extroverted nature of architectural students` imagination. The conflict between the results of learning styles grouped by inspiring space type and idea generation style created the requirement of a qualitative study to find out the classification of different kinds of inspiring personal space.

7. Application

Reflector learning style participants were the earliest submitters of their images and appeared in interviews as artistic individuals caring about details and appreciating connections. The ten images submitted showed, in Figure 9, the mutual characteristics of inspiration needs relative to territoriality and feeling satisfied. Connecting with the indoor and the outdoor contents are the headline of reflectors' needs as all of them handed similar images containing floor-to-ceiling windows and a teamwork atmosphere. Besides, they all referred to comfort as the blend of light and shadow in the same space. One of the students quotes in this regard, "Light and shadow give me the dynamic and movement of imagination, Also I feel settled in shadow as it makes me feel I am home" (quoted from a student, ID: C29), noticing that participant ID refers to the academic level of students.

Figure 9. Reflector learning style preferences of inspiring space, (left) the output of a very strong reflector female, student ID: A04, and (right) the output of a very strong reflector male, student ID: B10 [Authors via Midjourney]

Activist learning style participants had some difficulties at first expressing their energetic nature and the need for different activities in one space. After the initial attributes, most of them showed significant interest in the design of space surfaces in specific. They emphasized moving between levels and using stairs to separate activity zones instead of walls. In addition to their active state of design practice, they mentioned their consideration of colors in space more than other learning styles. Their favorite colors in their workspaces are always worm colors, especially tended yellow. By asking them to identify their visual

connections and whether they like to have an outdoor view, they didn`t care that much about landscape view. Although one of them, student ID: C03, asked to include visual contact with other workspaces claiming that the indoor view of surrounding peers refreshes his mode of enthusiasm. Prominently, their images implied as shown in Figure 10 the priority of diversity in floor levels as quoted from an interview with a very strong activist female student, ID: D34, "I like the inspiring space to be connected with other space as long as the

surrounding spaces are hosting the same activities with a wide space to move between tables and have chat with my friends".

Figure 10. Activist learning style preferences of inspiring space, (left) the output of a very strong activist female, student ID: C03, and (right) the output of a very strong activist male, student ID: A14 [Authors via Midjourney]

Theorist learning style participants have analogies with activists related to the

concern of space elements` design. They have got the most duration of describing their needs with a lot of details in consideration. Therefore, the results of the text-to-image generation study came as expected to be full of details. Reflecting on their incredible capabilities of discussing and building evaluative theories, they required a closed circle of social interactions without feeling separated or resorting to crowded open discussions. Most of them care about artificial lighting and mentioned their willingness of using the inspiring space at late night in addition to natural daylight which comes in second place and furniture pieces of the space. They showed, as shown in Figure 11 strong inclination to work inside a group with a limited number of peers concerning spacing from other groups. Considering their description, the study quoted from a male participant (ID: D24) that "I need a tidy space and a comfortable chair to think clearly in idea generation".

Figure 11. Theorist learning style preferences of inspiring space, (left) the output of a very strong theorist male, student ID: A06, and (right) the output of a strong theorist female, student ID: D06 [Authors via Midjourney]

Figure 12. Pragmatist learning style preferences of inspiring space, (left) the output of a moderate pragmatist male, student ID: D25, and (right) the output of a very strong pragmatist male, student ID: D14 [Authors via Midjourney]

Pragmatist learning style participants, only two students, have been observed with an essential need for solitary privacy to be able to focus. They emphasized the importance of silence and a content space to be settled in without any noise or loud voices. Sharing their private aura is optional in the case of a partner or a close friend. Furthermore, each of them was confident of their desire for a visual connection with silent Nature precisely green Nature. Their realistic view affects their social connection during idea generation as they consider teamwork crowds and informal discussions a waste of time and a kind of distraction. That's why they asked for a calm space to experience territoriality and greenery integration to heal from anxiety, as shown in Figure 12.

8. Conclusion

The inquiries about the influence of learning style preferences on architectural students' needs in their inspiring space have targeted the development of design criteria for building more effective inspiring spaces caring for students` different environmental needs. The quantitative study conducted on volunteers (92 percent) of the publication indicated a common preference for personal inspiring spaces for half of the participants with different learning styles and 31 percent preferred the intermission space. While only 19 percent showed an inclination to the presentation space. In this regard, the results primarily implied a mutual nature of the possible inspiring spaces, in most cases, it should be dynamic with free space available for informal activities. Aside from studying the impact of learning styles on the environmental needs of inspiring spaces, the results marked the high percentage of Reflectors and Activists among the sample (72 percent) in addition to the low percentage of Pragmatists (only four percent). The reflection of this outcome confirms the previous research work on architectural students that settled the conclusion that most architectural students tend to be Reflectors during the learning process. The qualitative study, on the other hand, tended to dig into the previous results. As the interviews led to the fact that although the three learning styles showed a higher percentage of preferring personal spaces, their different attitude in the idea generation phase required different styles of personal space. Therefore, the development of design criteria for the characteristics of different inspiring personal spaces is shown in Table 3 to separate the environmental needs of the learning styles of architectural students. Although the majority appeared to be attracted to the personal space type, their nature of inclination appeared to be different in the following aspects:

- Territoriality nature and their affection or emotional relationship with personal space, as reflectors and pragmatists are the most students giving much concern to their inspiring space.
- Privacy regulation and their level of interacting with others during idea generation, as reflectors and activists are the most open mind to work within a friendly environment with partners.
- Landscape view integration and visual connections with the natural environment, as reflectors and pragmatists like to have direct visual contact with a landscape view.
- Seating style, as each learning style, is observed with a preference for seating position and direction. For instance, the artistic imagination of reflectors and their social interactions created an affinity to a cocktail seating style with the flexibility of changing seating positions. However, theorists with their tendency of evaluating and discussing theories required comfortable furniture units.
- Activity priority and their impulsive notion to get into the mood, as activists find their inspiration in dynamic actions and changing situations.
- Outdoor accessibility and the link between indoor and outdoor content, as reflector and activist are the most learning styles associated with outdoor integration.

Table 3. The design criteria for inspiring personal spaces for architectural students [Authors]

Style / Needs	Reflector	Activist	Theorist	Pragmatist
Territoriality	The use of a **permanent** preferred space as a **primary territory** to enrich their self-confidence feeling of belonging	The use of temporary spaces as **a secondary territory** because of their active mode to satisfy their massive power and need for a dynamic environment during idea generation	The use of **unsettled** territory as a **secondary territory** enables them to move between several crits and make use of discussions	The use of a **permanent** major space as a **primary territory** to be able to think inside a quiet focused space as a way of creating self-concept
Privacy	They don't need any barriers between them and their peers. As they usually **acquire knowledge** within a **friendship regulation**. While in **transformation process**, they prefer sharing their experience in an **intimacy regulation**.	They prefer to interact with their peers and share people their experiences. As they usually **acquire knowledge** within a **friendship regulation**. While in **transformation process**, they solve design problems in a repeated experiment as they are observed in a	They **acquire and transform knowledge** within in a **reverse regulation** to use discussions with peers, watching their practice, and give people their opinions	They prefer to have a private space without being observed prefer. As they usually **acquire knowledge** within a **reverse regulation**. While in **transformation process**, they use the invisibility of working freely in an **anonymity regulation**

		reverse regulation.		
Landscape View	**Direct** contact with a landscape view	**Indirect** contact with a landscape view	**Indirect** contact with a landscape view	**Direct** contact with a landscape view
Seating	• **Cocktail** seating styles and sometimes **sitting on floors** • **Natural** materials • Inside a **group** of peers • **Attached** drafting tables or up to 6 inches distance in between • Directed To any **exterior view** in field of vision	• Regular **classroom** seating and sometimes **boardroom** style • Near groups or included in a **teamwork** of peers • Drafting tables are up to 48 inches **distance** in between • Around the central area, near a **corridor** or a pathway	• **Cabaret** seating style with **comfy** chairs • Inside evaluation and **discussion spots** • Sometimes to a side wall of **permanent gallery** • **Distancing** each group of discussion from the other • Reflectors and activists` groups are in their field of vision	• **Solitary** seating style away from social gathering and noise • To a **corner** or near to a vertical **column** in the space to feel content • **Natural** materials • Seating direction to the outdoor **quite landscape**
Activity Priority	Architectural **sketching and modeling** within social gathering and informal teamwork	**Planning and moving** among different spaces to get rid of mental stagnation	Architectural **evaluation and discussion** inside a specific group of crits	Productive architectural **simulation and virtual modeling**

Outdoor Accessibility	**Direct** access for outdoor area through a veranda or a terrace	**Direct** access to walkways, staircases, or corridors	**Indirect** access for outdoor spaces to avoid distraction	**Indirect** access for outdoor spaces to avoid distraction

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1]   A. Quinlan, L. Corkery, N. Marshall, "Positioning The Design Tutor's Presence in The Design Studio for Successful Student Design Learning," in *International Conference on Design Education*, Sydney, Australia, July 2007.

[2]   J. Liamzon, et al, Distance Anxiety: Effects of Personal Space on Anxiety on Third year Education Students, vol. Presented to the Faculty of the B.S Psychology Department In partial fulfilment of the requirements of Experimental Psychology, San Mateo, 2017, pp. 1-8.

[3]   A. Guney, S. AL, "Effective Learning Environments in Relation to Different learning Theories," *Procedia - Social and Behavioral Sciences 46,* p. 2335, 2012, https://doi.org/10.1016/j.sbspro.2012.05.480.

[4]   P. Lueth, The Architectural Design Studio as a Learning Environment: a Qualitative Exploration of Architecture Design Student Learning Experiences in Design Studios from First Through Fourth-Year, Ames, Lowa State: in partial fulfillment of the requirements of the degree of Doctor of Philosophy, 2008, https://lib.dr.iastate.edu/rtd/15788, pp. 33-61.

[5]   A. Namazian, A. Mehdipour, "Psychological Demands of the Built Environment, Privacy, Personal Space and Territory in Architecture," *International Journal of Psychology and Behavioral Sciences,* vol. 3, no. 4, pp. 110-111, 2013, DOI: 10.5923/j.ijpbs.20130304.04.

[6]   D. Kivanc, Relationships between Density, Crowding, Privacy, and Dormitory Satisfaction: the Case of Bilkent University Dormitories, Ankara: In partial

fulfilment of the requirements for the Degree of Master of Fine Arts, 2016, http://hdl.handle.net/11693/32229, pp. 6-7.

[7] A.Y. Kolb, D.A. Kolb, "Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education"," in *Encyclopedia of the Sciences of Learning*, vol. 4, Academy of Management Learning & Education, 2005, http://dx.doi.org/10.1007/978-1-4419-1428-6_227, pp. 193-197.

[8] C.C. Yuksel, I.D. Uyaroglu, "Experiential Learning in Basic Design Studio: Body, Space and the Design Process," *The international Journal of Art & Design Education,* vol. 40, no. 3, pp. 508-513, August 2021, https://doi.org/10.1111/jade.12364.

[9] K. Peterson, at al, "Moving and Learning: Expanding Style and Increasing Flexibility," *Journal of Experiential Education,* vol. 38, no. 3, pp. 230-239, 2015, https://doi.org/10.1177%2F1053825914540836.

[10] S. Pelsmakers, et al, "Developing Architecture Studio Culture : Peer- Peer Learning," in *Education, Design and Practice – Understanding skills in a Complex World 17.1*, New York, June 2019, https://architecturemps.com/proceedings/.

[11] J.T. Hemdan, D.S. Taha, I.A. Cherif, "Relationship Between Personality Types and Creativity: A Study on Novice Architecture Students," *Alexandria Engineering Journal,* pp. 1-11, September 2022, https://doi.org/10.1016/j.aej.2022.09.041.

[12] S.R. Herring, B.R. Jones, B.P. Bailey, "Idea Generation Techniques among Creative Professionals," in *The 42nd Hawaii International Conference on System Sciences*, 2009, http://dx.doi.org/10.1109/HICSS.2009.241.

[13] Abdellatif, W, ElKhodary, E,, "A Critical Review on the Differences between an Art Student and a Design Student in their Critical Thinking and Learning Style," *Journal of Design Sciences and Applied Arts,* vol. 1, no. 2, p. 80, June 2020, DOI: https://dx.doi.org/10.21608/jdsaa.2020.28503.1013.

[14] K. Thoring, et al,, "Inspiration Space: Towards a theory of creativity-supporting learning environments," in *Design Management Academy Conference 2017*, Hong Kong, 2017, http://dx.doi.org/10.21606/dma.2017.19.

[15] A. Riggs, The Creative Space: Art and wellbeing in the shadow of trauma, grief and loss, Victoria University, Melbourne, Australia: Submitted in fulfillment of the requirements for the degree of Doctor of Philosophy, 2010, https://vuir.vu.edu.au/id/eprint/16014, pp. 8-24.

[16] K. Thoring, P. Desmet, P. Badke-Schaub, "Creative Space: A Systematic Review of The Literature," in *The 22nd International Conference on Engineering Design (ICED19)*, Delft, The Netherlands, August 2019, http://dx.doi.org/10.1017/dsi.2019.33.

[17] K. Thoring, Designing Creative Space: A Systemic View on Workspace Design and its Impact on the Creative Process, Berlin, Germany: Submitted for the purpose of obtaining the degree of doctor at Delft University of Technology, October 2019, http://dx.doi.org/10.4233/uuid:77070b57-9493-4aa6-a9a5-7fed52e45973, pp. 51-108.

[18] K. Thoring, C. Luippold, R.M. Mueller, "Creative Space in Design Education: A Typology of Spatial Functions," in *International Conference on Engineering and Product Design*, Artesis University College, Antwerp, Belgium, September 2012.

[19] N. Börekçi, "Visual Thinking Styles and Idea Generation Strategies Employed in Visual Brainstorming Sessions," in *DRS 2016, Design Research Society 50th Anniversary Conference. Brighton, UK*, Middle East Technical University, Turkey, June 2016, http://dx.doi.org/10.21606/drs.2016.147.

[20] L. Zamberlan, S. Wilson, "Developing an Embedded Peer Tutor Program in Design Studio to Support First Year Design Students," *Journal of Peer Learning,* vol. 8, no. 1, pp. 7-12, 2015, http://ro.uow.edu.au/ajpl/vol8/iss1/3.

[21] Z. Torabi, S. Brahman, "Effective Factors in Shaping the Identity of Architecture," *Middle-East Journal of Scientific Research,* vol. 15, no. 1, pp. 107-108, 2013, http://dx.doi.org/10.5829/idosi.mejsr.2013.15.1.2357.

[22] M. Khalil, "Idea Generating Techniques in Architectural Design Education: Exploring Students' Perceptions," *International Journal of Engineering Education ,* vol. 37, no. 1, pp. 66-70, 2021.

[23] H. Demirkana, O.O. Demirba, "The Effects of Learning Styles and Gender on The Academic Performance of Interior Architecture Students," *Procedia Social and Behavioral Sciences,* vol. 2, no. 2, pp. 1390-1394, 2010, http://dx.doi.org/10.1016/j.sbspro.2010.03.205.