

Research Article

An Innovative School Design Based on a Biophilic Approach Using the Appreciative Inquiry Model: Case Study Scandinavia

Amjad Almusaed ¹, Asaad Almssad ², and Karim Najjar ²

¹Jönköping University, Department of Construction Engineering and Lighting Science, Jönköping, Sweden

²Karlstad University, Faculty of Health, Science and Technology, Karlstad, Sweden

Correspondence should be addressed to Asaad Almssad; asaad.almssad@kau.se

Received 13 February 2022; Revised 7 April 2022; Accepted 7 May 2022; Published 25 June 2022

Academic Editor: Timothy O. Olawumi

Copyright © 2022 Amjad Almusaed et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

To understand the school's role in society and its works, it became essential to reevaluate its functions and importance for society after the aggressive attack of the COVID-19 pandemic. Thus, a new educational space design represents a powerful and required tool for stimulating creativity and increasing concentration, motivation, and assimilation of knowledge for future generations. The article will use appreciative inquiry as a method that works with perspective ideas readings dotted by high positive human sensitivity. It also represents a powerful tool for the students' opinions about the teaching spaces and environments. To improve the performance of educational institutions and schools, considering the sustainability concepts and biophilic designs has become an urgent necessity within the Scandinavian countries and in the world in general. The scientific research and theoretical analysis within the biophilic theory have been conducted to see how the designer can integrate the nature components holistically in the educational environment based on spatial, visual, and ecological integration concepts. The study aims to develop knowledge about applying biophilia as a phenomenon in educational institutes of Scandinavia where the students among others are the main decision-maker. The article's main finding is that students dream of free open teaching spaces integrated with nature, where the biophilic theory frameworks are suitable to form this sustainable model that enables educational institutions and schools to improve their performance within different stages of the study.

1. Introduction

Scandinavian countries and other areas worldwide had taken an urgent response regarding the COVID-19 pandemic [1]. After the aggressive action of "COVID-19," a critical change in school form and function is required. Pokhrel and Chhetri wrote that the COVID-19 pandemic had created the largest disruption in education systems. They think that reopening the schools after the relaxation of restrictions is another challenge with many new standard operating procedures. That means a new procedure needs to be adapted after the COVID-19 pandemic [2]. Martínez and Sancho reported that it required a new understanding of the teaching environment and the nature of the interaction between virtual spaces and school spaces and how this interaction affects the development of students' learning processes [3]. Espino-

Díaz et al. believed that the COVID-19 pandemic affected directly the teaching system, where the schools need to adapt their teaching system through a new holistic teaching environment that needs to be found based on the psychological factors of school spaces users, under the novel approach of the contributions of neuroeducation in the field of managing emotions and motivational processes, contributing to meaningful learning in students [4]. Using a physical school classroom in the regular form will generate creative development in their life, and it will help them to be active. Poulain et al. thought that the students receiving learning materials from school regularly spent significantly more time doing schoolwork at home than children receiving materials only irregularly [5]. The education system has empowered all people to realize their full potential, giving a reason to increase studies in this area of research and to pay

attention to the new generation of school buildings. The future is finding a relation in synchronic, syncretic, diachronic mode, adapting human being dream and requirements within nature or which is oriented towards the application of the concepts of the living harbor with a high sensory value, which can define the efficient building by applying to the concepts of twinning with nature in a better life ability [6, 7].

The school or teaching space is not a learning space but a temple where priests are the interactive environment and teachers. According to Almusaed et al., the school is among the most widespread buildings in the world and has societal importance for embracing a large segment of occupants, for not short periods of time [8]. Therefore, it needs to have the power to inspire and influence students through relations to the outside, transparency, configurations, and integration of nature in the classroom area. There is a tension between working within the boundaries of an outdated system and implementing it under departmental leadership in a typical classroom. However, Janette thought that reconfiguring one's classroom into a "maker space" is one potential solution to this tension [9]. Consequently, the design of teaching spaces needs to be more precise and with multilevel action. Oliveras-Ortiz et al. thought that the learning spaces are thereby crucial [10]. Biophilic schools and using plants and nature integrated into the school spaces are not taken in our schools today. Ghaziani et al. thought that biophilia would be a design resolution in schools because of its impact on users' health and well-being. It remains pretty unexplored in school design in many countries [11]. Consequently, improving the school design based on the biophilic design concept and users' dreams using appreciative inquiry has become required. This process is necessary to improve our school spaces to be more productive, attractive, and innovative.

The appreciation inquiry (AI) method is a joint search for the best for the students and teachers, their organizations, and the world around them. It involves the systematic discovery of what gives the system "life" when it is most efficient and capable economically, ecologically, and humanly. A positive educational survey using an appreciative inquiry approach will increase student motivation and help them become livelier and more effective [12]. Moreover, AI brings about social change in the learner, as the emphasis is on what is good and believes that people educate what they value, not what they dislike.

As part of getting the future schools into a socially sustainable modern community, the school's premises need to create innovative school internal and external spaces supported by natural elements in an integrated model in which the participatory approach can be a part of it. Thus, the students will not only be the end-user of such environment's decision-makers as well. The theory-based evidence shows that such isolation from nature negatively affects the student's performance and mental abilities [13]. This negative impact is verified by several scientific types of research that focus on a person's physical and psychological health. The students feel that they work in an unattractive space and unmotivated process. The main problem is how the students can feel positively and productively in the

teaching space. They actively participate in its formation and design and what the optimal environmental code is. In recent years, there have been solid global trends and severe attempts by ministries of education globally in general and EU in special, where the Scandinavian region takes a long way to improve the reality of teaching institutions and schools. This improvement is through the design and construction of schools and educational systems on a human scale that meets the requirements of the recent generation by applying the concepts of sustainable and effective methods for the future generation.

Much scientific research in the environment and health supports that virgin nature or man-made nature in the urban environments stimulates many positive energies and leaves psychological and physical effects on man [14, 15]. Evidence in attention restoration theory (ART) [16] suggests that nature serves as a positive restorative environment for humans and is an effective platform for stress management, health promotion, psychotherapy, and disease deterrence. Biophilia, the innate human attraction to nature, is a concept that has been recognized for several decades by the scientific and design communities and intuitively for hundreds of years by the population at large [17, 18]. The concept of biophilia implies that humans hold a biological need for connection with nature on physical, mental, and social levels, and this connection affects our well-being, productivity, and societal relationships. The philosophy of biophilic design has evolved to develop revolutionary concepts based on the integration of nature and its simulations in the built environment at several levels and manifest itself in the three following pillar concepts which represent the tenets of biophilic design. These pillar concepts are nature on the space, natural analogues, and nature of the space. In this article, the researchers try to apply the concept of biophilia to the urban environment of educational institutes and to the whole educational process to come up with a new model and examine the dream schools meaning for students for the post-COVID-19 pandemics.

Moreover, the realization of biophilic design as a concept of human centrality identifies the relationship between mental nutrition and general characteristics of the stereotypical formations surrounding the human being and how they affect and interact with the human mind [17]. In general, the school building is not just a building; it is also good to come daily to prepare for the future. The school should not be just a place for learning, although this is the main reason. Therefore, the role of an educational institute in general and school becomes strategic and essential for societies.

2. Methodology and Materials

Many factors determine the effectiveness of the introduction of a new learning environment for the next generation of schools, by making them more creative and efficient:

- (i) Students need to acquire new skills and competencies regarding the teaching process and components

- (ii) Schools have to reform the teaching spaces meaning to be more attractive and creative
- (iii) Teaching environment must be more open and flexible to other teaching tools and systems to create a creative teaching space, that means to create multiform, functions, and cultures of the space in one flexible teaching area
- (iv) Educational spaces have to take another meaning code to be hybrid by a combination between physical and natural environments (biophilic spaces)

The method used will follow a complex analysis which will be divided into two areas: mental space analysis which will be used for appreciative inquiry regarding the 4 selective biophilic factors. One analysis regarding the space form and functions is required, which represents the physical space analysis, which include students' activities, space specific functions, and the space form as shown in Figure 1.

According to the new situation, architects need to create attractive and efficient healthy classrooms by applying biophilic design within school design, which means a new school space and learning environment can be found in the new generation of schools in the north of Europe.

Why appreciative inquiry (AI) approach?

Appreciative inquiry has been found to be a useful tool for leadership educators, as its foundation in social constructionist philosophy aligns with contemporary leadership and learning theories. Appreciative inquiry (AI) is a strength-based, positive approach to leadership development and organizational change [19]. In educational spaces, the essential requirement is to raise the students' engagement in the learning process. Appreciative inquiry as a starting point is about focusing on what works and examining what makes it work [20]. It is an organizational development theory based on the basic assumption that employees and students are successful in their activities in all institutions, which offers great potential for development in the future (Figure 2). When working with growth in this way, there is a greater chance that the development will not only be about patchwork solutions to existing problems. Thus, the method is theoretically in line with theories.

Using appreciative inquiry (AI), the process is laid out in a process consisting of four phases. The four phases are continuous; however, one can jump between the phases and repeat them based on what needs to emerge, as given in Table 1.

3. Biophilic Factors (BF) within the School Spaces Model

3.1. A Review on Biophilic Factors of Students' Reflection on Teaching Spaces. The biophilic factors represent the objective reading of student dreams and reflections regarding the future school and teaching spaces. These factors are divided four categories which reflect the requirement needs to be met (Tables 2–6).

3.1.1. Daylight Impact on Teaching Spaces. The reading regarding daylight impact concludes that light levels significantly impact performance and visual function in schools. Unsatisfactory lighting can distort the information received by a student through sight, increasing the likelihood of loss of vision during the entire teaching period.

3.1.2. Greenly Elements and Spaces on the Student Temperament. The educational process takes place in a biophilic environment and precisely in spaces where there is an integration between the functional spaces and the elements of nature from water, green, and air which will inspire students and activate them with additional creative mental capabilities. There is no doubt that the biophilic design places the human in the center and tries to adapt the environment to human needs and not vice versa.

3.1.3. Colors and the Student Temperament. Colors in biophilic concept create relaxation and feel joy or sadness. The color sensation is usually subjective, but color effects are almost universal in perception [33]. When choosing colors in classroom environments, the functional aspects rather than aesthetics of color should be emphasized. Overstimulation through color creates sensory overload [34]. The color of the walls and the height of the ceiling in rooms influence children's willingness to cooperate [47].

3.1.4. Creative Classroom Functions. No one will deny that classrooms, their design, and the layout of classrooms play an essential role in the effectiveness of the educational process.

The relation between the students' dream for a healthy learning process and the basic analyses required to create an attractive teaching space needs to be clear and objective. In this situation, it is required to implement the idea "the teaching space follows students' activities." All detailed descriptions and information have to follow the student's requirements and dreams. Figure 3 shows the process of and working process from the activities to the teaching space configuration.

3.2. Biophilia within Students Physiological and Psychological Interaction. Biophilia as a technique is based on humans' mental and physical mechanisms in response to the natural environment [48]. Therefore, it is necessary to consider the very nature of human beings to assert that biophilic design is necessary and not optional. Many readers may mistake biophilia's attention to nature, in this sense, as an attempt to distract the attention of humanity itself, although the purpose is to improve human life. Only recently, a scientific explanation was given to those who were initially the mystical-religious practices related to architecture and design a new concept of designing a school, which look at the true essence of the human and the natural environment to build lovely spaces. Students are physiologically and psychologically connected to those structures characterized by organized complexity, while this link is smaller than planes

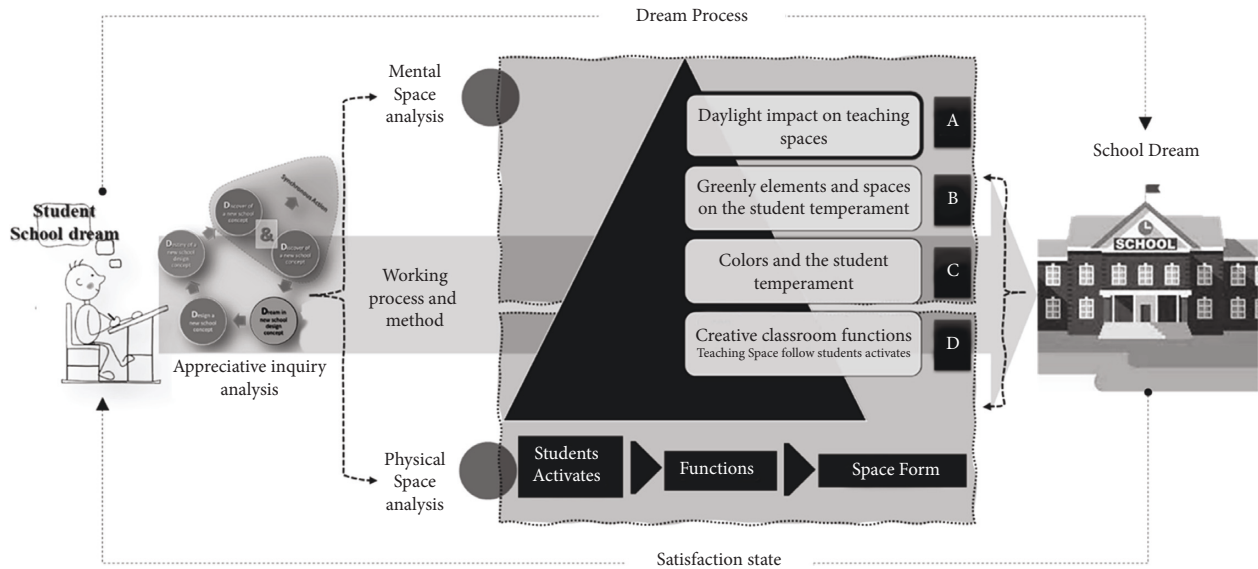


FIGURE 1: A figurative presentation of the detailed method stage work.

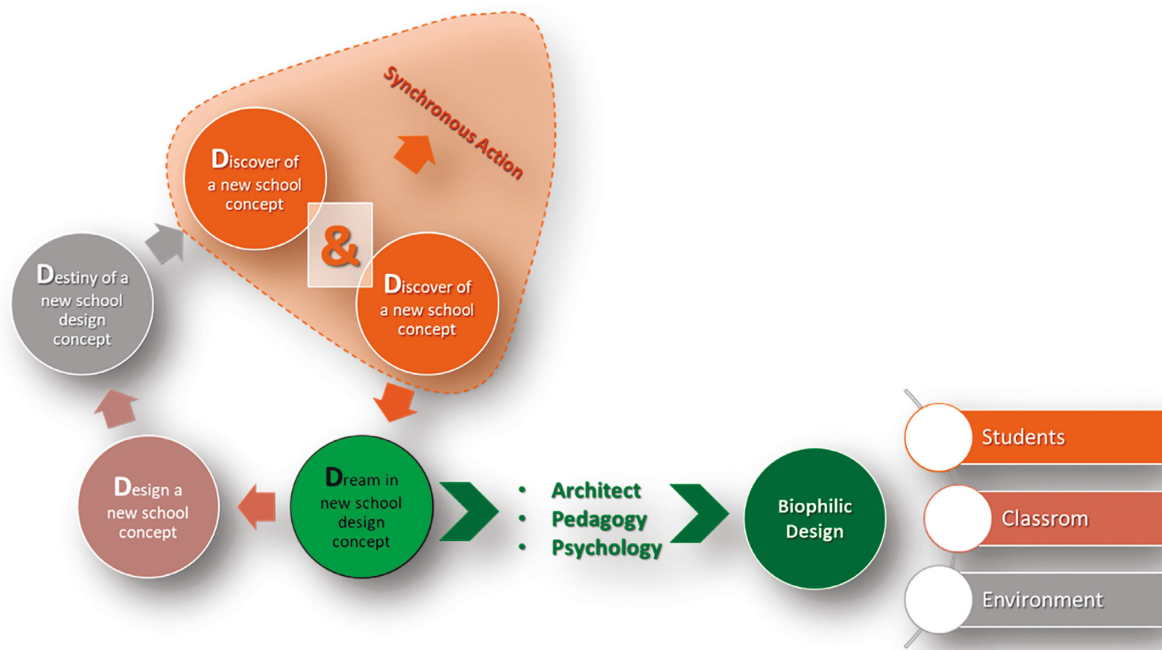


FIGURE 2: The four phasis of appreciative inquiry interaction with biophilic school design.

TABLE 1: Appreciative inquiry (AI) action.

Phase	Working area	Working target	Activity
Define and discovery	Reading of success stories and potential “experiences.”	Find out and appreciate the best solution	Focusing on the highlights of the school from the unique factors of school design
Dreams of the future	Fantasia, unrestrained, supported by imaginative conceptualizing	Expand the potential of the organization	Challenging the stagnation by imagining a more valuable and vital future
Design phase	Creation of the common ambition	Design of height and direction	Recreate the school’s social structure and staging
The realization phase	The road to target and solutions	The driving force and potential for renewal are exceptionally high at this point in the process	Realization of the new visions and ambitions for the school future.

TABLE 2: The impact of daylight on the student engagement.

Biophilic factors (BF) role in user building action		
	Impact description	Reference
Daylight impact	Have a substantial effect on the intellectual ability	[21]
	Not represent an essential factor regarding the teaching process	[22]
	Have an indirect impact on the teaching process	[23]
	Have an impact on the users physiological	[24]
	Have an impact on students learning ability	[25]
	Daylight improves the students' vision and perception and contributes to students: health, comfort, and productivity	[26]

TABLE 3: The impact of greenly elements and spaces on the student engagement.

Biophilic factors (BF) on student's temperament		
	Impact description	Reference
Greenly spaces	Using green spaces in teaching-assisted students to increase their knowledge and their ability to understand many subjects.	[27]
	The classroom views to green landscapes cause significantly better performance on tests of attention and increase a student's recovery from stressful experiences.	[28]
	The green space can foster performance and, over time, help reduce such disparities	[29]
	Nature immersion has a big effect on creativity and student productivity	[30]
	A higher surrounding greenness contributes a better academic performance in students of all grades	[31]
	The green schoolyards promote positive development outcomes among youth living in urban, low-income neighborhoods by providing natural and safe spaces.	[32]

TABLE 4: The impact of colors on the student engagement.

Biophilic factors (BF) on student's temperament		
	Impact description	Reference
Colors	Color impacts student behavior within the physical learning environment. Due to the move toward including students with disabilities in the general education classroom, functional color applications are critical.	[33]
	Colors help learners increase their attention levels on certain information, which helps such information to be transferred to short-term and long-term memories, thus increasing their chance of memorizing such information	[34]
	The colors influence students' performances and cognitive loads, stimulate students' emotions, and motivate them to learn.	[35]
	The access to natural views, plants, and green increase visual creativity.	[36]
	A color choice is important when decorating a classroom. Teachers should keep in mind that red and orange can make students feel nervous and unsettled, while blue and green can help students feel calm.	[37]
	Different colors influence students' affective states, which have an impact on their workload, and in turn degenerate their performance	[38]

environments or has a chaotic complexity [49, 50]. It follows that the students can feel positively and productively in teaching space; the built environments prove to have a crucial function, equal to "nature." The environmental protection and improvement functions are multiple, reaping at different green spaces [51]. According to Wilson, a human being in general and students in special mode are biologically predisposed to seek contact with natural forms [17]. One cannot live a complete and healthy life away from nature. Therefore, it required direct contact with life forms, not with the miserable surrogates, "what is seen today in so many works of architecture. The hypothesis about Wilson' biophilia states that we need contact with nature and the complex geometry of natural forms as much as we need for our metabolism of nutrients and oxygen. It also involves introducing the building into a natural environment instead of simple environmental destruction to make space for the building" [48, 52]. Today, the biophilic phenomenon of




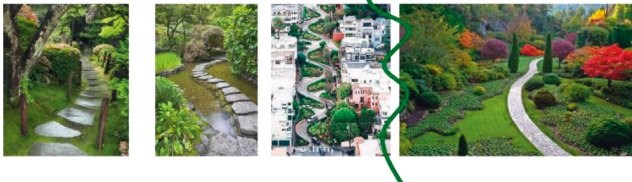
school becomes one of the leading projects, which supports any educational process in the world as all components of the educational process.

3.3. *Biophilia within Schools' Functions and Spaces (Reading and Proposal)*. The study supports measurable, positive impacts of biophilic design on health, strengthening the empirical evidence of the human-nature connection and raising its priority level within both design research and design practice; however, little guidance for implementation exists [52–54]. Nowadays, it is finally possible to build a building to intensely "tied in," giving scientific explanations and expanding the geometric logic of the natural world for the built one. To summarize, two different currents are highlighted in the contemporary ecological design [48]. Today, the biophilic phenomenon of school becomes one of the leading projects, which supports any educational process in the world

TABLE 5: The impact of creative classroom functions.

Biophilic factors (BF) on student's temperament		
	Impact description	Reference
Creative classroom form, functions, and design	The classroom must be arranged in a form in which it has a sense of execution of an "acceptance approach" in classroom management and the entire teaching-learning philosophy of schools	[39]
	Classroom design helped students work at their optimal level of challenge and allowed students to learn holistically.	[40]
	The importance of using a classroom's symbolic conception, such as objects and wall décor, in influencing student learning and achievement in that environment.	[41]
	The furniture arrangement in the classroom influences how comfortable students feel and the interaction with other students and the teacher	[42, 43]
	Various classroom spatial layouts influence intensely learning activities and the teaching process.	[44]
	The physical learning space arrangement influences how teachers and students perceive the influence, effectiveness, and teacher usage of one-to-one.	[45]
	The classrooms at school require adaptation to the new contexts and roles in education	[46]

TABLE 6: Green areas type in outer spaces.

	Green area form
Open green spaces	
Green organized in spots	 <p style="text-align: center;">Green spots</p>
Green strips arrangement	 <p style="text-align: center;">Green strips</p>
Green mixed system	

as all components of the educational process. A practical application of biophilia as a new concept in an educational program help to minimize the negative impact of buildings and the operation of buildings on the surrounding environment [55]. It must start before the design process and after

implementation in the urban site. Biophilia in the school building has to take a different form in the reading process; it can be represented as a natural phenomenon integrated into the building design concept or a technique and technology required for a modern lifestyle. Green areas are the most

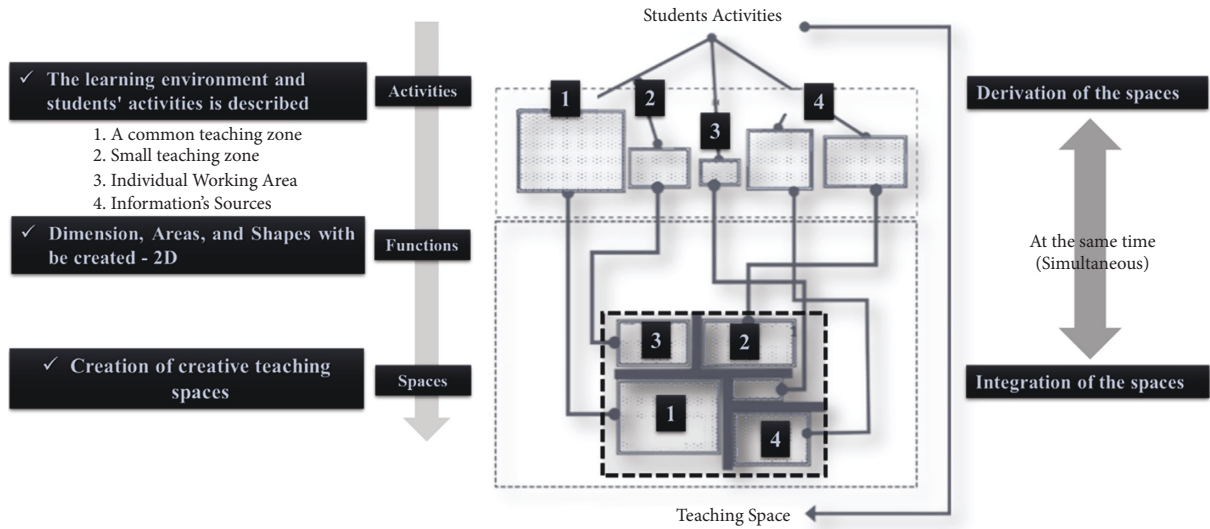


FIGURE 3: The concept of idea “teaching space follow students activates” in the real action method.

important visual associations between land, buildings, and the sky, the most prominent of all plant life, and without their presence, our townscapes would be naked [50]. The application of biophilia as a concept in school building design is about joining students and school staff to nature; keeping attentive on this objective will help the group to stay focused on strategies that involve the educational institute form, materials, spatial responses, and psychological replies to space rather than simply introducing a limited green roof, walls, or enhancing natural daylight [56].

3.3.1. *The Greenly Categories within School Spaces.* The views from a window at home or work can afford pleasure. Similarly, landscape areas can also cause satisfaction; satisfaction achieves contact with many kinds of nearby nature. Green areas in outer spaces can take many forms. The green space can be distributed in open space, spots, stripes, or mixed according to the garden’s design, where the concept tends to introduce valuable areas that can manifest by their specific spatial configurations.

3.3.2. *The Greenly Composition and Form.* Groups of trees and shrubs may consist of one or more species, but it is recommended that they include a maximum of two or three species. A variation of a large assortment of species may be adopted, provided that in each sector of the green space, a particular species predominates, which is the leading stock, preferably a local species, and the grouping of the wood species shall be made in such a way as to give a natural impression, thus achieving unity within the diversity of composition. The world of green areas in biophilic schools depends on many factors [57]. In the designing process of a biophilic school, it is necessary to create a composition of plants depending on the height of the copies in this situation as shown in Figure 4; the architect must “comprehend” in the future:

- (i) How they will look

- (ii) How much the respective specimens will have
- (iii) How they fit into that composition

High-grade, high types are suggested for the following:

- (i) Large court school areas, which can be as recreated areas, can be a solution to preventing unsightly urban functions as industrial areas and the center of cities
- (ii) Creating shading required of buildings
- (iii) Creating a vertical accent in different configurations
- (iv) Conveniently, the wood species are divided into many categories as given in Table 7

They can be used alone or in grouping with other species as shrubs.

Small tree species and shrubs are suggested for small plants’ lengthways of the walkway with an essential main to generate a positive environment and produce a shading for pedestrian walkways and prevent penetration of dust and exhaust gases. Besides that, it helps in bringing variety to the unity of the configuration, which for its unique decorative result. Figure 5 shows the selecting trees using in the conformation of a plant’s compositions.

3.3.3. *Linking Elements and Paths in Open Spaces.* The movement of students between school building using the pedestrian walkways or between the different indoor and outdoor spaces is an important and vital action that can give the impression and advantage of the value of outer space. Pedestrian walkway represents one of the most critical external spaces. A useful walkway required attention in the design process for creating a biophilic architecture (Figure 6). The form, colors, use model, and the material involved all represent the walkway’s characteristics. Pedestrians and walkways play an essential role in shaping the overall textures and materials of confirmation of open spaces, including outdoor educational institutional spaces.

TABLE 7: Trees and shrubs highs and categories.

Tree types	High	Shrub types	High	Others
T.1	Over 25 m	S.1	Blew 7 m	Climbing, clinging or despite creeping wood species, where the stems can have lengths from 1-2 m to 10-20 m and even more.
T.2	15-25 m	S.2	2-7 m	
T.3	7-15 m	S.3	1-2 m	

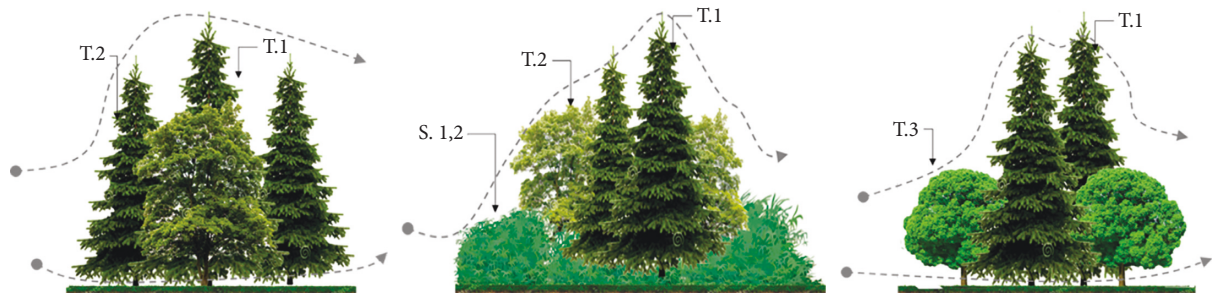


FIGURE 4: Different forms of front creation of many types of plant compositions.

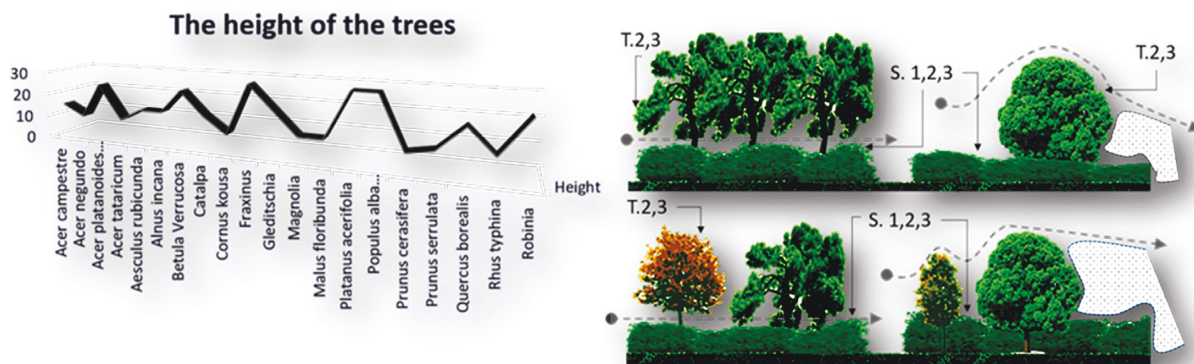


FIGURE 5: Selecting trees using in the conformation of a plant’s compositions.

They vary according to the way they are organized and the flow and the directions of walkways that make up a different image. The general texture, the form of any broad open texture, can be done in complex form according to the schemes that include the unique structure of external spaces and the types of road patterns [58–60].

The movement paths should be streamlined by a method that creates a balanced reading of the components and does not exaggerate the space form and configuration because the functions of the educational institutions within the educational program require simple forms. Therefore, the basic node configuration starts from outside and not from inside. The square and rectangle shape and circle represent the most common forms and considerations in the educational institute plans.

3.3.4. *The Greenly Inside the School Building.* As an essential target phenomenon in modern architectural interior design, biophilia has to be integrated with the components of the

interior’s objects to be a part of the integrated design process [61, 62]. It has to be taken in evidence like essential elements required for human living value like physical comfort which represents an essential factor for human life and environmental quality [63]. As a result, the application of biophilia as a phenomenon in interior spaces has to encourage a love of the place. More recently, students in California showed that educational institutes that used outside teaching space and other forms of nature-based experiential education were related to significant student gains in social studies, science, language arts, and math. One study found that students in full greenly interior spaces enhanced their skill testing scores by 27% [64–66]. A study showed that the nature in the space has a stronger relationship with occupant cognitive well-being. A natural analog, as the preferred biophilic intervention, has a stronger relationship with occupant emotional well-being [33, 67, 68].

On the other hand, the color of plants and objects is used. Color can be a signal for action, which can affect the mood



FIGURE 6: Walkway and pedestrian as a linking tool in school.

and cause various physiological reactions. Color in the biophilic concept creates relaxation and feel joy or sadness. The color sensation is usually subjective, but there are color effects, almost universal in perception [68]. The colors on the red side of the spectrum are warm: red, orange, and yellow. They can cause feelings of warmth and comfort as well as aggression. The blue colors of the spectrum are cold and include not only blue but also purple and green. They are neutral colors, but they can also cause feelings of sadness or indifference. Yellow, for example, is a color of life, especially summer and sunlight. It is suitable for educational institutes, besides orange. They bring optimism, happiness, idealism, and imagination [69, 70]. It is optimistic, modern, and energizing. The meanings of the life color are satisfactory, intellect, rapid learning, memory, collaboration, organization, cleanliness, enthusiasm, curiosity, wishes for improvement, hope, illumination, and energy [61, 71]. In biophilic design, architectural spaces can be identified as function but identical in configuration and activities. In real life, no two spaces can be similar: in this case, an efficient biophilic school tent to applicant diversities in spaces creation. The phenomenon can create different architectural space, orientation, space functions, users, and plant types [72–74].

4. The Analysis and Results

The study analyzed the relation between the student's dream ideas for his teaching environment and the teaching places in schools according to biophilic factors. The local attachment refers to the emotional connection between people and their place of residence [75]. It plays a central role in the relationship between man and land, which is also a viewpoint generally agreed by scholars. The human-land relationship includes positive emotions, such as love and satisfaction, and negative emotions, such as fear and sadness. Although

negative affective connections can constitute a vital place meaning, place attachment usually refers to the positive emotions formed by the interaction between people and place. The main point of this theory is that place attachment is a framework that includes three dimensions: person, mental process, and place. It is a big difference between what we need for our learning process and what we dream of for this process. When student "DREAM," it means he feels thrilled, ecstatic, and peaceful (The student dreams a new classroom life within a utopic vision). According to students' reading regarding the requirement, they needed classroom to feel satisfaction representing what can be within the school to be in standard. A survey tool has been developed to explore the school learning spaces to create the evaluation mechanism. It will be done by registration of the students' opinions regarding the dream classroom, which is linked to biophilic factors (BF). As mentioned before, thematic content analysis was chosen because of its demonstrated use for investigating questions where existing data are limited; however, it promotes a systematic approach for comparison of results with existing theory [54]. Online web surveys shared on social media are also a quick and easy way to gather information. Another advantage is that the respondents themselves can choose when and where it is appropriate to answer the questions. The questionnaire is essential to state whether the survey is anonymous or not and explain how the participants' contributions will be applied in work [58]. This method provides a broad knowledge of, among other things, students, teachers, and the administration employee's experiences, opinions, and feelings. For this target, the authors selected five biophilic factors to be debated by students from 5 schools. The students were selected to be creative. The study will examine the collected data through a thematic analysis method to see if there are common patterns of a consensus or collective approach

among the students for the specific qualities of the indoor and outdoor biophilic designs in their school's school environment. The research results were based on the theoretical and practical aspects of the creation of feasible requirements that serve the development of the educational environment process. In addition, it is taken into consideration the development of regional authenticity by the local material resources. The authors intended to have an in-depth insight into the students' preferences when it comes to propose any spaces, components, or elements in the indoor or outdoor spaces.

4.1. Selecting and Contacting Schools. For getting the study target, the schools' samples were required to be located within the Scandinavian area, Denmark, and Sweden, including students aged 17–19 years from high schools. In addition, it was desirable that the schools selected would provide a relatively even geographical spread across the Scandinavia area, where Sweden and Denmark cover the study required to ensure that the students are not influenced by the school position, specific educational climates, and ethnic backgrounds. Based upon these eligibility criteria, 5 schools were purposively selected for inclusion into the study. Before the student starts writing his dream ideas, they need to read a document regarding the biophilic school to understand the meaning of this concept. In this case, the authors choose five high schools, two schools from Sweden (Karlstad region) and three from Denmark (the capital region of Denmark) with a total of 25 selective students from the final year of secondary school from both countries as shown in Figure 7.

The students started to write their dream ideas regarding five factors, where they need to describe their dreams in detail to be clearly understood. The thinking area for them was open. However, they need to be as practical as they can. Many students sent their dream ideas. Some of the pictures were isolated and exaggerated, the authors excluded them, and they selected just the repeated statements, despite some partisan differences; however, they agreed on the concept. Then, ideas were reformulated to be unified under a proposed vision. The survey was divided into 5 study areas as the main biophilic factors (BF) using the appreciative inquiry (AI) approach.

4.2. The Daylight in the Classroom. Not every space can be designed to include all the principles of biophilic design. Therefore, elements are used to improve the interior and well-being of those who spend many hours inside the classroom (Figure 8).

Students tend to understand the effect of daylight as a factor of well-being and enjoyability in closed spaces. Therefore, the dream ideas were intensifying daylight by a significant area of windows, adjustable lighting level, and color by using smart systems and orienting to transparent in dividing spaces.

4.3. Colors in Classroom Spaces. To express the sense of space, we must pay special attention to the composition of the picture and the processing of the edge lines. Brightness



FIGURE 7: Schools selected position in regional areas of Scandinavia.

contrast is the color contrast formed by the difference in brightness. Brightness contrast occupies an important position in the color composition. The brightness contrast of colors mainly realizes the color, the three-dimensional effect, and the spatial relationship. Students clearly expressed their ideas regarding the colors. They have exciting pictures. Some of the suggested ideas were linked to the technology (Figure 9).

4.4. Nature in the Open School Spaces and Throws the Windows. Biophilic design denies the transition to industrial design in the twenty-first century and the clean, minimalist “millennial aesthetics” that prevails worldwide. Proponents of biophilic design believe that since people have lost their basic connection with nature, there is an urgent need to implement this principle. The most substantial knowledge that school gardening provides also does well for human well-being in general. One hundred twenty minutes of stay in parks and similar environments per month significantly affects human well-being [76] (Figure 10).

According to the students' requirements and dreams, the overall layout of the school courtyard is required. Therefore, a carefully formulated school plan for greening and beautifying the school courtyard includes greening and beautification, trees and flowers, and arrangement of flower beds, sculptures, pavilions, terraces corridors, and other architectural sketches.

4.5. Nature Inside the School Space. Nature inside the school space design is essential for current schools, especially from the current COVID-19 pandemic and climate change crisis; our urban life seems to have lost contact with the natural world and disconnected from it. Human beings are part of

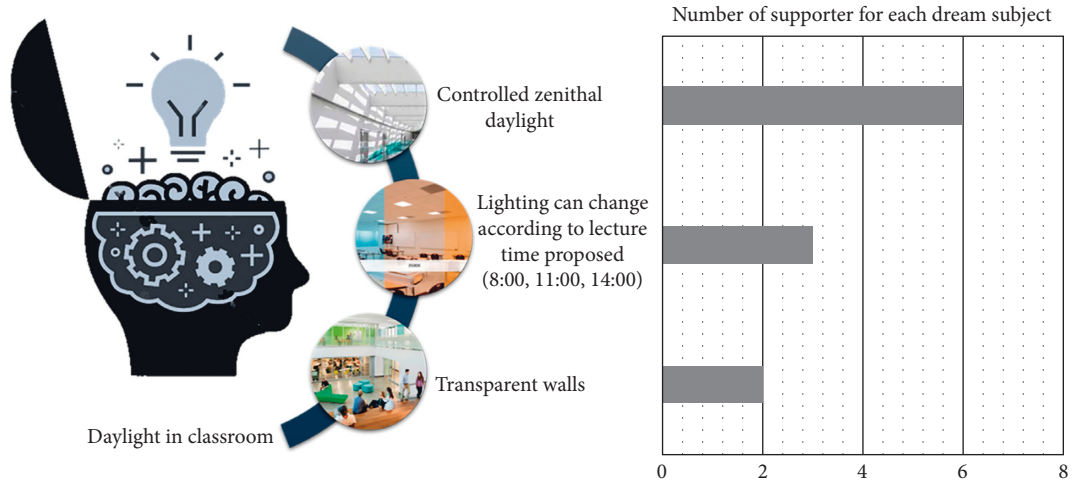


FIGURE 8: The analysis of daylight factor, the dream ideas and supporters.

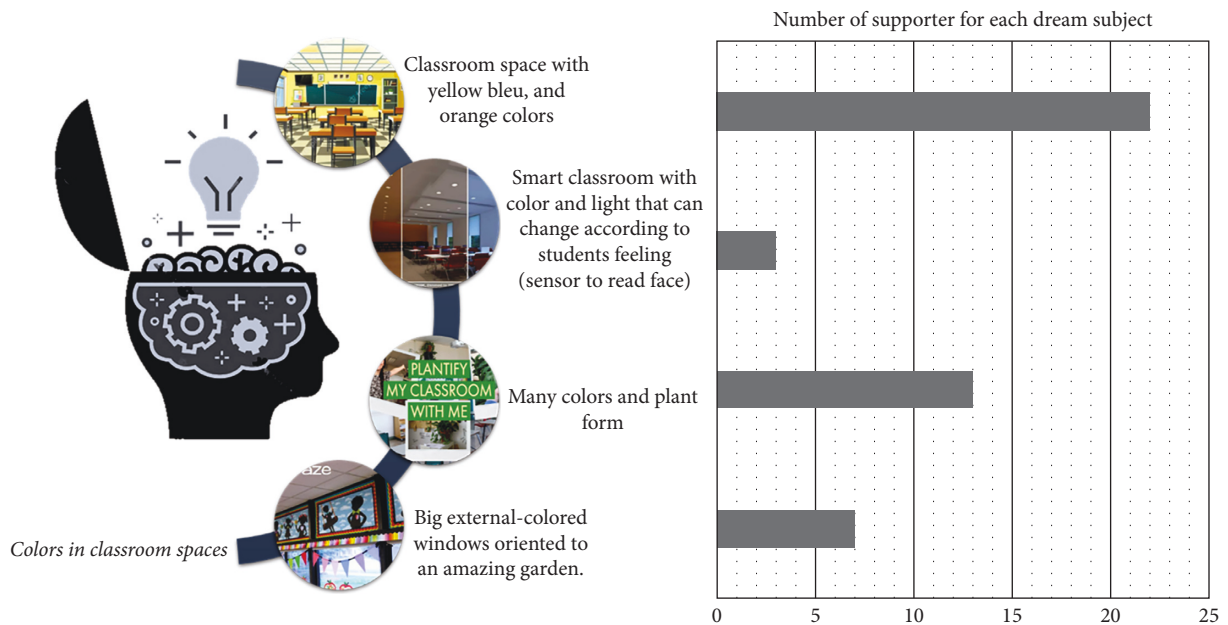


FIGURE 9: The analysis of colors in classroom spaces, the dream ideas and supporters.

nature; whether we like it or not, human beings are part of its system (Figure 11).

The biodesigned buildings combine natural lighting and ventilation, natural landscape features, and other elements to create a more efficient and healthier learning environment.

4.6. A Novel Classroom Layout and Function. In traditional educational institutes, students acquire knowledge in a teaching space context. They are then sent away to synthesize, analyze, and evaluate this after the lesson, where the students feel not integrated into the educational process. Thus, the academic space is gloomy and out of ambition. Students suggested new classroom form, layout to correspond to the student’s dreams (Figure 12).

The results showed many ideas have a creative reading and imagination (Figure 13).

The schools outdoor landscape design and gardening were the main idea dreams for many students.

5. Discussion

Taking all the readings, reviews, and analysis evidence into account, creating a new form of the classroom by using the students’ dream ideas related to biophilic factors can help create changes required for our schools today and will have merit. The theoretical review of this research is how to use the appreciative inquiry approach in creating a new form of classroom spaces by using biophilic factors in the design process as main principles and guidelines that have evidence

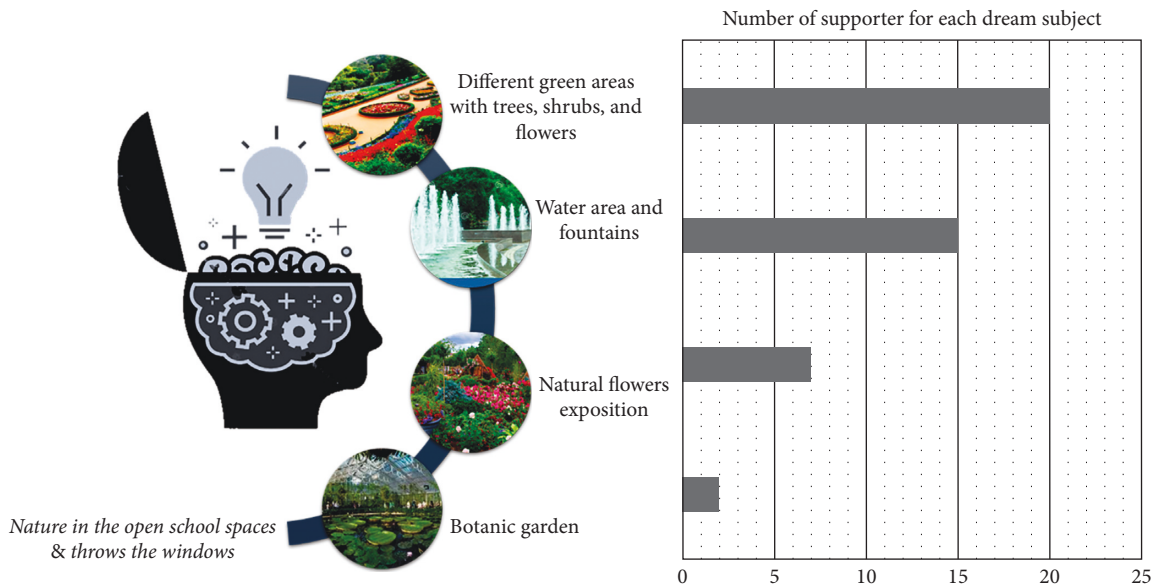


FIGURE 10: The analysis of nature in the open school spaces and throws the windows, the dream ideas and supporters.

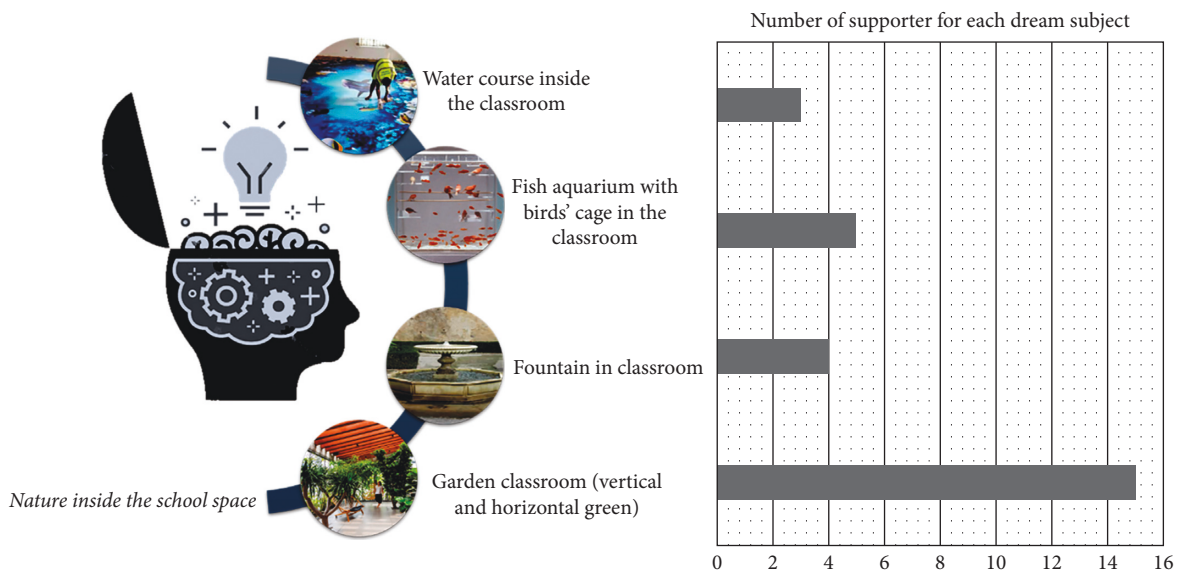


FIGURE 11: The analysis of nature inside the school space, the dream ideas and supporters.

in many relevant scientific types of which were read in this research. The study shows the positive impacts on human health and well-being as well. Grinde et al. affirmed that nature in living spaces will increase positively valued changes in cognition and emotion, which again may impact stress level, health, and well-being [77, 78]. The biophilia can be achieved through the connection to nature in its visual and nonvisual manners. This connection will improve attentiveness and happiness and lower stress hormones. The positive impact of applying biophilic factors in reducing students' stresses and enhancing learning outcomes is advocated by Determan et al. in their research project [79]. The essential requirement for biophilic schools is maintaining the highest level of the appropriate health environment,

which has to fit the educational process's arrangement. Air quality is a key determinant of any sustainable green building, where clean air plays a role in maximizing functional performance within the interior space. The different procedures of physical comfort from heat, humidity, and an acoustic take the first jobs in the classification and promotion of internal space required by the educational process in a biophilic school. The biophilia can be sensed through nonrhythmic sensory stimuli complexity and order. These types of sense can positively impact sympathetic nervous system activity, blood pressure, and heart rate. Moreover, it lowers the stress response. The biophilia can manifest itself through biomorphic forms and activate transparency and using of natural materials. Bringslimark et al. [80] focused

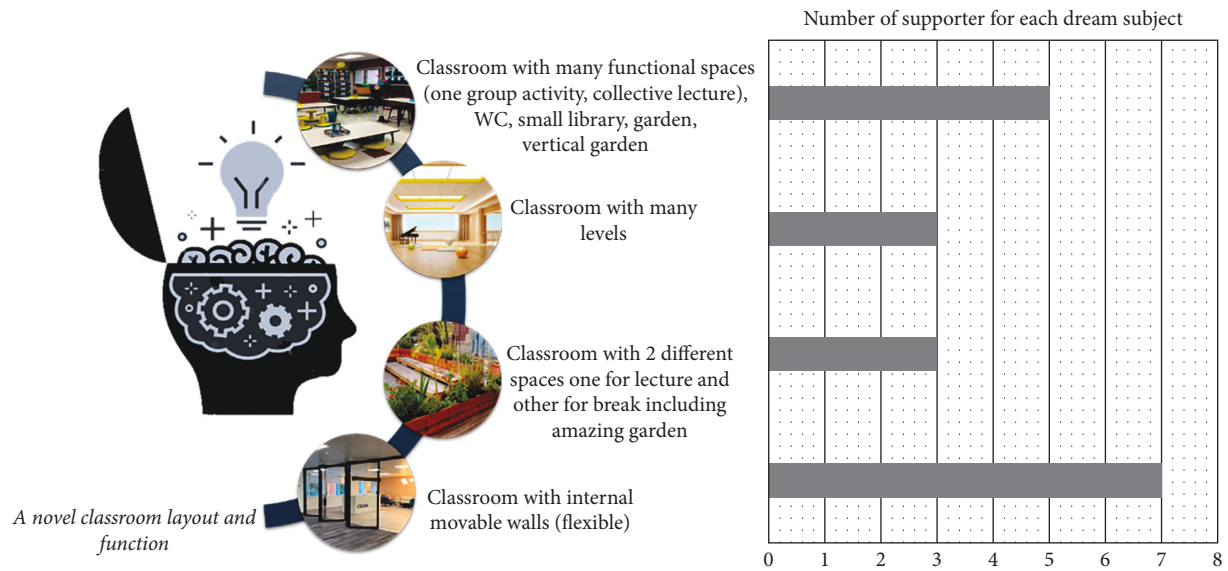


FIGURE 12: The analysis of a novel classroom layout and function, the dream ideas and supporters.

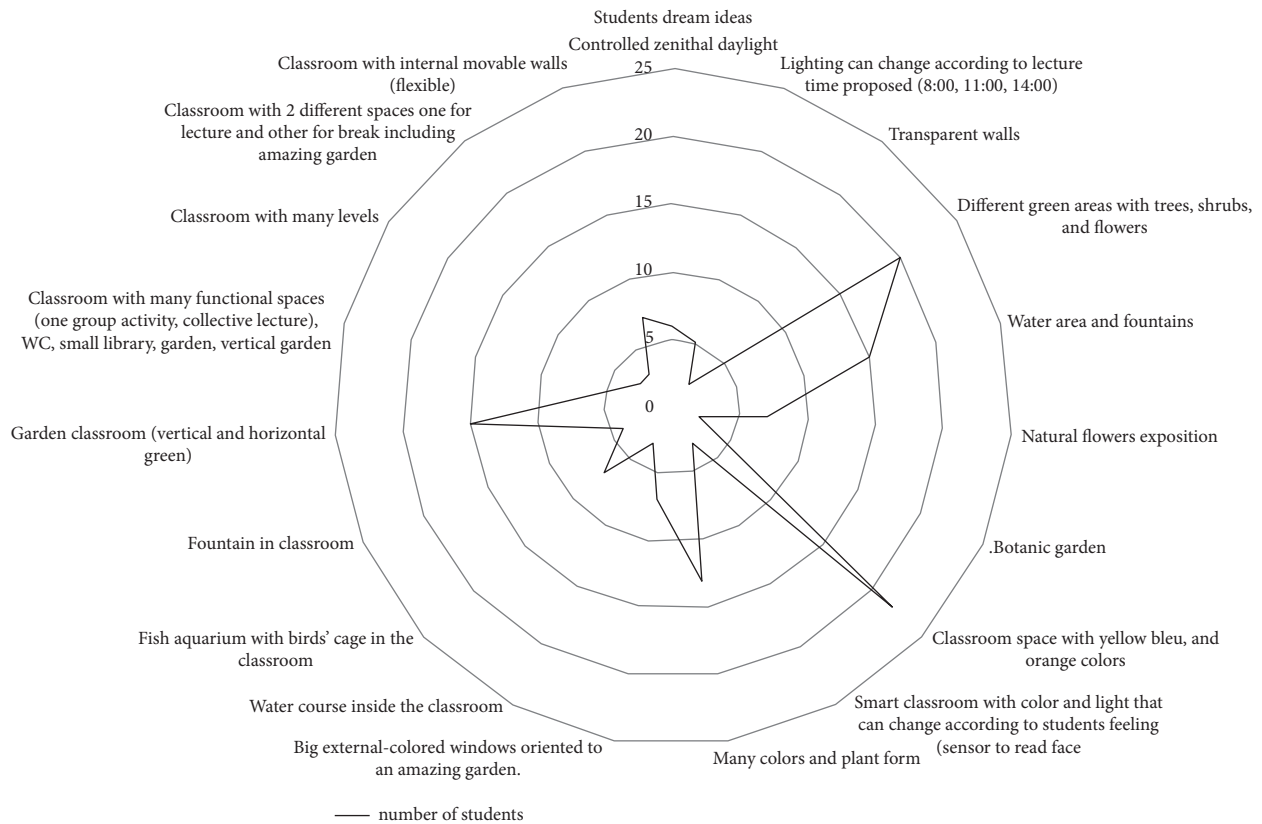


FIGURE 13: The analysis diagram of the selected priorities of ideas by students.

on the benefit of using indoor plants in buildings, which is created through passive interactions with indoor plants, including emotional states, pain perception, creativity, task performance, and indices of autonomic arousal.

The biophilia can be achieved through mystery, risk, and prospect and refuge. These factors can reduce fatigue, boredom, and stress. Besides, it improves pleasure and

comfort. The use of vertical gardens in buildings are suitable for the goals and directions of sustainable environmental buildings as they are in the field of public health. According to do Valle Santos et al., the vertical gardens directly affect the quality of buildings and internal spaces and take an important role regarding acoustic and thermal comfort, air quality, and positive contribution to human psychology [81].

Reforming classroom functions by integrated or derived classroom functions can find reflections in students' dream ideas, which will be revolutionary solutions under the topic of "making the spaces." According to Knaub et al., the characteristics of the classroom environment play an essential role in shaping teaching spaces in useable form and supporting research-based instructional strategies [82]. In the context of creating optimal schoolwork upon a sustainable system, it required eliminating excess spaces or over-definition of space within a single function or unjustified use of resources in the light. Also, recruiting architectural spaces requires adjusting activations to the optimal use of spaces and elements, whether through the functional area or the formation of the functional system. That can allow a smooth connection between the spaces. The connecting corridors, which were virtually absent in the school's functional unit, benefit spaces. Educational programs have to be classified according to what is required in the educational plan and the general education requirements. Thus, it will become more useful and human and less space loss. Educational units can be transformed into other larger or smaller jobs as required in the active practice of sustainability in the use and recycling of assets and spaces.

According to students' ideas, selecting and developing the school project site requires considering the potential and opportunities of natural site elements. Remediation of a wrong exist of elements is a required process. An examination of the site orientation and, most significantly, the advantages and disadvantages of the site will support the positives and reduce the negative consequences. An objective selection of the educational institute site is in relationship with site potentials and the overall shape of the building for the acquisition of thermal and optical energies and to reduce the effects of external noise and the rest of external influences. Ryan and Holtman affirmed that the biophilic school concept must acknowledge the forms and processes found in nature and translate them into spaces and through spontaneous collaborations with nature in the built environment [83].

The study reveals that the student dreams in a new concept of school which integrates nature in classroom spaces in an effective and creative form. They suggest bringing green nature to the classroom and the outer gardens, and they do care about both the indoor and outdoor spaces within the school environment. The students prefer mostly among other biophilic factors the form of landscape design and gardening in outdoor spaces to be as open fish aquarium and include water and pools. All these indicate that the students show the optimal way to activate the biophilic factors in outdoor school spaces. Besides, they show clearly that they prefer to take their lecturer within the natural green spaces. While in the indoor landscape, they prefer that the natural elements in the inner spaces must include vertical and horizontal gardens.

The results show that the students clearly show that the lectures in planting spaces are the most preferable among other options. The same situation we mentioned for inside school spaces, where the students' ideas integrated natural elements inside and outside of building school spaces. Many

students prefer to divide the classroom in many spaces in different forms to enjoy their time together.

Teaching in outside spaces represents an exciting idea, in which some student thinks that can be a new experience for them. MacQuarrie suggested encouraging teachers to engage with nature and outdoor spaces and broaden their approaches to teaching and learning, where learning outdoors complements children's indoor experience. [84].

The experience of education in the open green space is an exercise ring to activate some of the joints of theoretical materials related to external elements such as biology. The experience gives students

- (i) Great ability to practice practical experience vividly and persuasively in terms of endoscopy and results
- (ii) Ability to achieve smooth interaction between student and external environment
- (iii) Positive interaction between the educational experience and the accompanying environment, which requires the activation of the green environment in most subjects of the study

Many levels with the diverse environment can offer new life events and diversity and multiform of collecting spaces. To explore what the students want to see mainly in the school environments indicate their bias to the natural elements. It can help to design more objectively as well. This novel method to let them be the main decision-maker will strengthen the feelings of place attachment and make the lovable environments stronger. Moreover, effective participation will make sense of place more objective in its wide sense. The authors speculate such a result because every human being is driven to nature very strongly and instinctively. In this research, we have discussed how the students like to see green with their eyes as they work and enjoy their breaks between lectures. But we must remind that the biophilic school does not only have advantages but also have some challenges. Many new materials and more sophisticated biological designs may increase the cost of green buildings. As a result of the questionnaire show, most students want sophisticated choices and designs. But in the long run, it may not feel so expensive if we invite more productivity to society through an effective teaching process in a biophilic school. Students like to create their classrooms well incorporated into the natural landscape. Moreover, it represents a dream for students to apply the knowledge of biophilic factors (BF) in teaching spaces which will play an essential role in creating a competent school, corresponding to the Scandinavian culture of nature and the environment.

Biophilic factors as a concept are based on the principle of balance to provide an essential and fundamental framework for understanding the significant meanings of the definition of sustainable school facilities that are related to the natural environment. The process of sustainable school design is based primarily on understanding the significant value of green spaces and the way they are distributed throughout the school and activating the dynamic dimension in achieving the overall balance of the systems. This does not leave the essential role of instilling the culture

of sustainability and natural balance in the educational system and the students' intervention in school and classrooms design process. In this context, the concept is emerging to cover all these principles and orientations, enhancing the relevance of these principles within the school curriculum. Currently, all traditional education systems are not sustainable support systems within the school environment approach.

6. Conclusions

In the contemporary built landscape, the user of school spaces is becoming more and more isolated from the beneficial experience of contact with natural systems and processes. Particular attention is paid to generate a new configuration of schools based on biophilic factors (BF) and supported by students' dream ideas using the appreciative inquiry (AI) approach, besides orienting to activation of conservation of natural resources. The natural landscapes are still those considered primarily attractive and aesthetically pleasing. Stress and depression are the main conditions that people have to overcome today. That is why schools are constantly looking for new ways to relax the atmosphere and provide better conditions and more workspaces. Nature is imperfect; therefore, humans and nature that blends with buildings bring nature's imperfect beauty to the interior, humanizing the space. Nature's actions in school spaces can highlight the big secret of biophilic design. It brings nature to the inside space (classroom) and makes us experience human nature as more beautiful and natural. Appreciative inquiry is an approach to organizations that focuses on a collaborative exploration of their strengths to develop new organizational plans and procedures. This approach can be used in schools preparing for expansion, reorganization, or a change of education strategy direction. It often approaches from a problem-solving perspective and looks for problems to be solved. As an appreciative study, the school works from the opposite direction to determine what works well for the school and uses this information to develop a strategy for the future. The article debated an essential study area after the digastric effect of COVID-19 pandemic on the teaching process. It concludes that new teaching spaces and processes are needed. It is not enough to think about required teaching spaces, but we need to create our dream buildings and spaces. Appreciative inquiry as a pedagogical method covers this area of research. This study took into evidence the factors required to be involved in creating a creative dream for students. The study analyses the relation between teaching activities required and teaching spaces determined by biophilic factors and students' dreams for future classrooms, where many students dream of open teaching spaces, dotted with special colors and green classrooms. The results of the study showed the importance of activating the biophysical environment in designing new schools based on community, educational effectiveness, and the impact of concept applications on the schools' form and outputs of the educational process, as well as the ability of applications to bring positive psychological, educational, and scientific changes on students and teachers, not to mention the environmental and climatic

role of concepts and applications. There are a lot of issues to consider when talking about the ideal school. Light, noise, mental, and emotional health are the most important elements. Thus, the recreation, as far as possible, of the human-nature connection, by approaching the biophilic concept in generating the spaces in which we operate, has been shown to have a significant impact on the health and well-being of the human being. Certainly, there is a strong connection between man and nature, and once the connection is established, the benefits are not delayed. Once we manage to implement the biophilic design correctly, we manage to enjoy more natural light, clean air, diversity in workspaces, our productivity level, and creativity increase, and our health status is visibly improved. Taking these benefits into account, it is easy to understand why this trend is enjoying popularity. The concept of a dream teaching space is very complex, and it is evident that environmental design plays a vital role in the design process of the new generation of schools as part of the building process as a theoretical base for urban elements in the future. These trends create schools that are functional and designed in an integrated manner with the surrounding environment. Consequently, it turns to serve the human effort to create a creative educational world and new schools that help to create a high symbolic urban society and environment. In another area, it can contribute actively to solving community and environmental issues by applying sustainability concepts that will pose a real challenge to the planet in the future. It has become imperative to begin applying the concepts of biophilic schools. The study concluded that the building, active healthy, and natural environment will contribute actively to making the success of the educational process and shortening many affairs. The intention is to provide an incubating climate through increasing the interest in introducing biophilia as a concept within the requirements in educational institutions of such a comprehensive design process of the urban environment in general and schools; together, all the positive elements can enhance the cultural and educational gains of schools and thus contribute actively to the development process of society and its institutions.

Data Availability

The data used to support the findings of this study are included within the paper.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

- [1] E. A. Yarmol-Matusiak, L. E. Cipriano, and S. Stranges, "A comparison of COVID-19 epidemiological indicators in Sweden, Norway, Denmark, and Finland," *Scandinavian Journal of Public Health*, vol. 49, no. 1, 2021.
- [2] S. Pokhrel and R. Chhetri, "A literature review on impact of COVID-19 pandemic on teaching and learning," *Higher Education for the Future*, vol. 8, no. 1, 2021.

- [3] J. M. M. Martínez and A. T. Sancho, "Interactions between virtual spaces and schools: a collective case study," *Future Internet*, vol. 12, 2020.
- [4] L. Espino-Díaz, G. Fernandez-Caminero, C.-M. Hernandez-Lloret, H. Gonzalez-Gonzalez, and J.-L. Alvarez-Castillo, "Analyzing the impact of COVID-19 on education professionals: toward a paradigm shift, ICT and neuroeducation as a binomial of action," *Sustainability*, vol. 12, 2020.
- [5] T. Poulain, C. Meigen, C. Sobek et al., "Loss of childcare and classroom teaching during the Covid-19-related lockdown in spring 2020: a longitudinal study on consequences on leisure behavior and schoolwork at home," *PLoS One*, vol. 16, no. 3, Article ID e0247949, 2021.
- [6] A. Nikuze, R. Sliuzas, J. Flacke, and M. van Maarseveen, "Livelihood impacts of displacement and resettlement on informal households—a case study from Kigali, Rwanda," *Habitat International*, vol. 86, pp. 38–47, 2019.
- [7] A. Almssad and A. Almusaed, "Efficient daylighting approach by means of light-shelve device adequate for habitat program in Aarhus city," *International Journal of Smart Grid and Clean Energy*, vol. 3, no. 4, 2015.
- [8] A. Almusaed, A. Alasadi, and A. Almssad, "A research on the biophilic concept upon school's design from hot climate: a case study from Iraq," *Advances in Materials Science and Engineering*, vol. 2022, Article ID 7994999, 12 pages, 2022.
- [9] M. Janette, "Innovative learning spaces in the making," *Frontiers in Education*, 2021.
- [10] Y. Oliveras-Ortiz, D. E. Bouillion, and L. Asbury, "Learning spaces matter: student engagement in new learning environments," *Journal of Education*, vol. 201, no. 3, pp. 174–182, 2021.
- [11] R. Ghaziani, M. Lemon, and P. Atmodiwirjo, "Biophilic design patterns for primary schools," *Sustainability*, vol. 13, no. 21, p. 12207, 2021.
- [12] V. Stulza, L. Francis, S. Pathrose, and A. Sheehan, "Appreciative inquiry as an intervention to improve nursing and midwifery students transitioning into becoming new graduates: an integrative review," *Nurse Education Today*, vol. 98, Article ID 104727, 2021.
- [13] T. Elmer, K. Mephram, and C. Stadtfeld, "Students under lockdown: comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland," *PLoS One*, vol. 15, no. 7, Article ID e0236337, 2020.
- [14] A. Almusaed, I. Yitmen, A. Almsaad, I. Akiner, and M. E. Akiner, "Coherent investigation on a smart kinetic wooden façade based on material passport concepts and environmental profile inquiry," *Materials*, vol. 14, 2021.
- [15] A. Almusaed, A. Almssad, R. Z. Homod, and I. Yitmen, "Environmental profile on building material passports for hot climates," *Sustainability*, vol. 12, 2020.
- [16] A. Alberto and B. Stimson, *Conceptual Art: A Critical Anthology*, The MIT Press, Cambridge, MA, USA, 1999.
- [17] E. O. Wilson, *Biophilia*, Harvard University Press, Cambridge, MA, USA, 1984.
- [18] A. Almusaed, *Biophilic and Bioclimatic Architecture*, Springer-Verlag London Limited, Berlin, Germany, 2011.
- [19] K. L. Priest, E. K. Kaufman, K. Brunton, and M. Seibel, "Appreciative inquiry: a tool for organizational, programmatic, and project-focused change," *Journal of Leadership Education*, vol. 12, no. 1, 2013.
- [20] L. Waters and M. White, "Case study of a school well-being initiative: using appreciative inquiry to support positive change," *International Journal of Wellbeing*, vol. 5, no. 1, pp. 19–32, 2015.
- [21] S. Porras Álvarez, "Natural light influence on intellectual performance. A case study on university students," *Sustainability*, vol. 12, 2020.
- [22] A. Almusaed and A. Almssad, *Introductory Chapter: Sustainable Housing – Introduction to the Thematic Area*, A. Almusaed and A. Almssad, Eds., IntechOpen, London, UK, 2022.
- [23] D. Aggio, L. Smith, A. Fisher, and M. Hamer, "Association of light exposure on physical activity and sedentary time in young people," *International Journal of Environmental Research and Public Health*, vol. 12, no. 3, pp. 2941–2949, 2015.
- [24] B. Abboushi, I. Elzeyadi, R. Taylor, and M. Sereno, "Fractals in architecture: the visual interest, preference and mood response to projected. fractal light patterns in interior spaces," *Journal of Environmental Psychology*, vol. 61, pp. 57–70, 2019.
- [25] J. Liberman, *Light Medicine of the Future*, Bear & Company Publishing, Vermont, VT, USA, 1991.
- [26] A. Dahlan and M. Eissa, "The impact of daylighting in classrooms on students' performance," *International Journal of Soft Computing and Engineering (IJSCE) ISSN*, 2015.
- [27] F. Jana and P. Pavol, "Prokop Plants have a chance: outdoor educational programs alter students' knowledge and attitudes towards plants," *Environmental Education Research*, vol. 17, no. 4, pp. 537–551, 2011.
- [28] D. Li and W. C. Sullivan, "Impact of views to school landscapes on recovery from stress and mental fatigue," *Landscape and Urban Planning*, vol. 148, pp. 149–158, 2016.
- [29] M. Browning and A. Rigolon, "School green space and its impact on academic performance: a systematic literature review," *International Journal of Environmental Research and Public Health*, vol. 16, no. 3, 2019.
- [30] M. Abdelaal and V. Soebarto, "History matters: the origins of biophilic design of innovative learning spaces in traditional architecture," *International Journal of Architectural Research: Archnet-IJAR*, vol. 12, pp. 108–127, 2018.
- [31] T. V. L. Wing, T. Y. T. Tam, W. C. Pan, and C. D. Wu, "How is environmental greenness related to students' academic performance in English and Mathematics?" *Landscape and Urban Planning*, vol. 181, pp. 118–124, 2019.
- [32] C. R. Bates, A. M. Bohnert, and D. E. Gerstein, "Green schoolyards in low-income urban neighborhoods: natural spaces for positive youth development outcomes," *Frontiers in Psychology*, vol. 9, no. 805, 2018.
- [33] K. S. Gaines and Z. D. Curry, "The inclusive classroom: the effects of color on learning and behavior," *Journal of Family & Consumer Sciences Education*, vol. 29, no. 1, 2011.
- [34] M. A. Dzulkifli and M. F. Mustafar, "The influence of colour on memory performance: a review," *Malaysian Journal of Medical Sciences: MJMS*, vol. 20, no. 2, pp. 3–9, 2013.
- [35] B. Chang, R. Xu, and T. R. Watt, *The Impact of Colors on Learning*, *Adult Education Research Conference*, University of Victoria, Victoria, Canada, 2018.
- [36] S. Studente, "Nina Seppala. Noemi Sadowska, facilitating creative thinking in the classroom: investigating the effects of plants and the colour green on visual and verbal creativity," *Thinking Skills and Creativity*, vol. 19, pp. 1–8, 2016.
- [37] J. L. Bucholz and J. L. Sheffler, "Creating a warm and inclusive classroom environment: planning for all children to feel welcome, electronic journal for inclusive," *Education*, vol. 2, no. 4, 2009.
- [38] S. Kumar, J. Sterkenburg, A. D. Jed, and M. Jeon, "Color effects on students' emotions and task performance in a web-

- based learning management system,” in *Proceedings of the 1st International Conference on Multimedia and Human Computer Interaction (MHCI'13)*, Toronto, Canada, July 2013.
- [39] C. P. Rijal, “Classroom management in schools,” *Journal of NELTA Surkhet*, vol. 4, 2014.
- [40] L. Melissa, “Rands ann M. Gansemer-top, the room itself is active: how classroom design impacts student engagement,” *Journal of Learning Spaces*, vol. 6, 2017.
- [41] S. Cheryan, S. A. Ziegler, and V. C. Plaut, “Designing classrooms to maximize student achievement,” *Policy Insights from the Behavioral and Brain Sciences*, vol. 1, no. 1, 2014.
- [42] B. Burgess and N. Kaya, “Gender differences in student attitude for seating layout in college classrooms,” *College Student Journal*, vol. 41, pp. 940–946, 2007.
- [43] S. H. Martin, “The classroom environment and its effects on the practice of teachers,” *Journal of Environmental Psychology*, vol. 22, pp. 139–156, 2002.
- [44] A. Douglas and J. A. Dyck, “Activity-enhancing arenas of designs: a case study of the classroom layout,” *Journal of Architectural and Planning Research*, vol. 20, no. 4, pp. 323–343, 2003.
- [45] B. Terry, “Making the space for space: the effect of the classroom layout on teacher and student usage and perception of one-to-one technology,” in *Proceedings of the Australian Computers in Education Conference*, Adelaide, Australia, October 2014.
- [46] G. Bautista and B. Federico, *D Smart Classrooms: Innovation in Formal Learning Spaces to Transform Learning Experiences*, 2016.
- [47] M. Read, A. I. Sugawara, and J. A. Brandt, “Impact of space and color in the physical environment on pre-school children’s cooperative behavior,” *Environment and Behavior*, vol. 31, no. 3, pp. 413–428, 1999.
- [48] S. Kellert, J. Heerwagen, and M. Mador, *Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life*, John Wiley, Hoboken, NJ, USA, 2008.
- [49] N. A. Salingeros, *Unified Architectural Theory: Form, Language, Complexity*, Sustasis Press, Portland, OR, USA, 2013.
- [50] C. Alexander, *The Nature of Order*, Center for Environmental Structure, Berkeley, CA, USA, 2002.
- [51] A. Almusaed, A. Almusaed and S. M. S. Al-Samarae, Introductory chapter: overview on grass topic, grasses—benefits, diversities and functional roles,” IntechOpen, 2017, <https://www.intechopen.com/books/grasses-benefits-diversities-and-functional-roles/introductory-chapter-overview-on-grasstopic>.
- [52] A. Scott, C. O. Ryan, W. D. Browning, and J. O. Clancy, *Patterns of Biophilic Design Improving Health & Well-Being in the Built Environment*, Terrapin Bright Green, LLC, New York, NY, USA, 2014.
- [53] A. Almusaed, *Intelligent Sustainable Strategies upon Passive Bioclimatic Houses: From Basra (Iraq) to Skanderborg (Denmark)*, Vol. 10, Aarhus school of architecture, Aarhus, Denmark, 2004.
- [54] R. E. Boyatzis, *Transforming Qualitative Information: Thematic Analysis and Code Development*, Sage Publications, Inc, Thousand Oaks, CA, USA, 1998.
- [55] K. Modi and S. Parmar, “Understanding biophilia and its integration with architecture,” *International Journal of Scientific Engineering and Research*, vol. 11, no. 5, 2020.
- [56] A. Almusaed, *Act: Urban Biophilic Theories upon Reconstructions Process for Basrah City in Iraq*, 2014.
- [57] F. A. Mustafa and F. R. Yaseen, “Towards the application of biophilic parameters in local buildings: a case study of bilkent school, erbil city- Iraq,” *International Journal of Technology*, vol. 10, no. 2, pp. 363–375, 2019.
- [58] R. Patel and B. Davidson, *Forskningsmetodikens Grunder—Att Planera, Genomföra Och Rapportera en Undersökning*, Studentlitteratur AB, vol. 96, no. 94, Lund, Sweden, 2019.
- [59] A. Lehner and T. Blaschke, “A generic classification scheme for urban structure types,” *Remote Sensing*, vol. 11, p. 173, 2019.
- [60] R. S. Ulrich, R. F. Simons, B. D. Losito, E. Fiorito, M. A. Miles, and M. Zelson, “Stress recovery during exposure to natural and urban environments,” *Journal of Environmental Psychology*, vol. 11, pp. 201–230, 1991.
- [61] F. S. Ioana, “Biophilic Dynamic Light Projections proposal for the revitalization of socially inactive urban spaces,” Master Thesis in Lighting Design, Aalborg University Copenhagen Faculty of Engineering and Science, Aalborg, Denmark, 2018.
- [62] V. S. Ramachandran and D. Rogers-Ramachandran, “The neurology of aesthetics,” *Scientific American Mind*, vol. 17, no. 5, pp. 16–18, 2006.
- [63] C. Wald, “Neuroscience: the aesthetic brain,” *Nature*, vol. 526, pp. S2–S3, 2015.
- [64] M. S. Kats, I. H. V. Emmerik, J. Blenkinsopp, and S. N. Khapova, “Exploring the associations of culture with careers and the mediating role of HR practices: a conceptual model,” *Career Development International*, vol. 15, no. 4, pp. 401–418, 2010.
- [65] T. Beatley and P. Newman, “Biophilic cities are sustainable, resilient cities,” *Sustainability*, vol. 5, pp. 3328–3345, 2013.
- [66] W. Browning, C. Ryan, and J. Clancy, *14 Patterns of Biophilic Design*, Terrapin Bright Green, LLC, New York, NY, USA, 2014.
- [67] C. Louise Bowman, “The Biophilic Classroom - the benefits of nature in a Learning Environment, RCZM Sustainable building performance analysis and design,” 2019, https://www.researchgate.net/publication/333619305_The_Biophilic_Classroom_The_benefits_of_Nature_in_a_Learning_Environment.
- [68] E. Smith, J. Lemke, M. Taylor, H. L. Kirchner, and H. Hoffman, “Frequency of voice problems among teachers and other occupations,” *Journal of Voice*, vol. 12, pp. 480–488, 1998.
- [69] S. Kamath, R. Kamath, B. D. Souza, and B. Soman, “Green buildings: sustainable construction principles,” *International Journal of Civil Engineering & Technology*, vol. 10, no. 1, pp. 1882–1892, 2019.
- [70] U. Ofer, *Safety with Dignity: Alternatives to the Over-policing of Schools*, New York Civil Liberties Union, New York, NY, USA, 2009.
- [71] L. Guan, A. Abbasi, and M. Ryan, “Analyzing green building project risk interdependencies using Interpretive Structural Modeling,” *Journal of Cleaner Production*, vol. 256, Article ID 120372, 2020.
- [72] S. Wu and Q. Liu, “Discussion on green building design and humanistic care,” *E3S Web of Conferences*, vol. 136, Article ID 03017, 2019.
- [73] Z. Xu, X. Wang, W. Zhou, and J. Yuan, “Study on the evaluation method of green construction based on ontology and BIM,” *Advances in Civil Engineering*, vol. 2019, Article ID 5650463, 20 pages, 2019.
- [74] A. Almusaed, “Introductory chapter: a general reading process on landscape architecture, landscape architecture - the sense of places, models and applications,” IntechOpen, 2018, <https://www.intechopen.com/books/landscape-architecture-the-sense-of-places-models-and-applications/introductory-chapter-a-general-reading-process-on-landscape-architecture>.

- [75] E. Charis and C. L. Anton, "Home is where the heart is: the effect of place of residence on place attachment and community participation," *Journal of Environmental Psychology*, vol. 40, pp. 451–461, 2014.
- [76] M. P. White, I. Alcock, J. Grellier, B. W. Wheeler, and T. Hartig, "Spending at least 120 minutes a week in nature is associated with good health and well-being," *Scientific Reports*, vol. 9, 2019.
- [77] B. Grinde and P. G. G. Biophilia, "Does visual contact with nature impact on health and well-being?" *International Journal of Environmental Research and Public Health*, vol. 6, no. 9, pp. 2332–2343, 2009.
- [78] A. Almusaed and A. Almssad, *Lessons from the World Sustainable Housing (Past Experiences, Current Trends, and Future Strategies)*, A. Almusaed and A. Almssad, Eds., IntechOpen, London, UK, 2021.
- [79] J. Determan, A. Mary, M. A. A. Akers, and T. Albright, *The Impact of Biophilic Learning Spaces on Student Success* Morgan State University The Salk Institute for Biological Studies and Terrapin Bright Green, New York, NY, USA, 2009.
- [80] T. Bringslimark, T. Hartig, and G. Patil, "The psychological benefits of indoor plants: a critical review of the experimental literature," *Journal of Environmental Psychology*, vol. 29, no. 4, pp. 422–433, 2009.
- [81] W. C. do Valle Santos, D. Singh, L. Delgado Leandro da Cruz, L. P. de Carvalho Piassi, and G. Reis, "Vertical gardens: sustainability, youth participation, and the promotion of change in a socio-economically vulnerable community in Brazil," *Education in Science*, vol. 9, 2019.
- [82] A. V. Knaub, K. T. Foote, C. Henderson, M. Dancy, and R. J. Beichner, "Get a room: the role of classroom space in sustained implementation of studio-style instruction," *IJ STEM Ed*, vol. 3, p. 8, 2016.
- [83] K. Ryan and A. Holtman, "The biophilic concept: framing learning with nature," in *Proceedings of the Environmental Design Research Association EDRA43 Emergent Placemaking*, Seattle, WA, USA, May 2012.
- [84] S. MacQuarrie, "Everyday teaching and outdoor learning: developing an integrated approach to support school-based provision," *Education 3-13*, vol. 46, no. 3, pp. 345–361, 2018.