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Identifying the Therapeutic Components of Daylight in the Educational Spaces of Sama Schools of Bojnord Azad University

Sahar Mohammadzadeh[1]

1. Corresponding author, Department of Architecture, Faculty of Art, University of Bojnord, Bojnord, Iran. E-mail: s.mohammadzadeh@ub.ac.ir

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ABSTRACT

Objective: This study examines the therapeutic dimensions of daylight in architectural design, focusing on Sama Schools of Bojnord Islamic Azad University. Drawing on environmental psychology, it explores natural light's role in students' mental well-being, cognitive performance, and physical health. It aims to identify therapeutic daylight components and propose strategies for integrating them into future educational spaces.

Methods: This applied quantitative study uses initial weights for nine therapeutic daylight components derived from a previous study employing the Analytic Hierarchy Process (AHP). These weights serve as baseline values for scenario-based sensitivity analysis. The weight assigned to serotonin production is adjusted across scenarios, and resulting rankings are compared with the baseline to examine effects on the relative priorities of other components.

Results: The reference study identified serotonin production as the highest-priority component, with a weight of 0.14. Sleep cycle regulation ranked second, at 0.13, while depression treatment and stress and anxiety reduction each received 0.12. The present study examines the stability of serotonin production's ranking and potential changes in other components' priorities following weight adjustments.

Conclusion: The findings emphasize the importance of therapeutic daylight in educational architecture. Sensitivity analysis can help assess ranking stability and support informed design decisions. Further research across diverse cultural and climatic contexts is recommended to evaluate the applicability of these components. The results should be interpreted within the scope of the selected evaluation framework, since AHP weights express relative priorities rather than direct measures of clinical outcomes or proof that daylight independently produces specific therapeutic effects in practice.

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Introduction

Investigating the psychologically driven behavioral relationship of designed environments has established a robust interdisciplinary connection between environmental psychology and other branches of psychology. One of the notable achievements of architectural design lies in crafting environments attuned to the emotional diversity of users. In contemporary times, stress remains a prominent area of inquiry across various scientific disciplines. Spatial environments exert significant influence over human feelings, emotions, personality, and mental states (Haridi et al., 2022). Educational facilities represent a core typology wherein individuals spend a substantial portion of their lives. The architectural quality of such spaces plays a decisive role in enhancing the educational experience. Consequently, an architectural approach informed by environmental psychology offers the potential to alleviate stress and promote relaxation among users (Barrett et al., 2015). Among key environmental determinants, natural daylight and access to outdoor views are especially influential—elements shaped by parameters such as window proportions, orientations, and visual openness. These aspects not only define environmental quality but also directly impact psychological well-being, particularly stress levels and emotional calm (Dudek, 2000).

Empirical evidence across diverse sociocultural contexts confirms a consistent perception of stress and a statistically significant positive correlation between exposure to natural light and views with stress reduction in educational settings. Enhanced exposure to these features is also associated with improved mental health and learning performance (Westwood et al., 2023). Notably, among these two variables, access to natural views has demonstrated a greater influence than daylight alone in fostering emotional recovery and cognitive performance (Clark & Moss, 2001). Educational architecture must continuously respond to students' physiological and psychological needs. Historically, the fulfillment of physiological needs has taken precedence, followed closely by ensuring a sense of safety (Ceppi & Zini, 1998). However, providing a mere functional environment without considering spatial quality fails to meet the layered demands of users. In the Iranian context, the concept of "school" extends beyond classrooms to include an integrated spatial fabric—comprising the physical surroundings—that must cater to the learner's aspirations (Hertzberger, 2008).

The physical environment, composed of factors such as texture, color, light, acoustics, volume, and form, profoundly influences both the body and psyche. Research in educational environments—from early childhood to higher education—demonstrates the impact of environmental design on user behavior, ranging from learning outcomes to feelings of belonging and social connection (Dudek, 2005). Thus, prioritizing environmental quality in educational design holds vast implications for societal development. The current study emphasizes daylight exposure and natural views as central architectural parameters that significantly contribute to

improving users' health, performance, and psychological well-being (Hamelin et al., 2023). Despite extensive literature highlighting the physiological and psychological benefits of natural light, architectural practice has often confined its application to visual and aesthetic considerations—neglecting its full potential. However, recent findings underscore how precise window design can enhance spatial performance and well-being (Lin et al., 2022). Light, as a multisensory architectural element, creates emotional responses and supports visual comfort. Selecting the appropriate lighting strategy in multifunctional buildings is inherently complex. Studies affirm that diverse lighting scenarios can shape spatial identity and affect user emotions. In particular, daylight, with its broad spectrum and visual consistency, remains unmatched by artificial sources and aligns optimally with human biological and psychological needs (Dunster et al., 2023). When thoughtfully integrated, daylight not only enhances environmental beauty and energy performance but also supports emotional and cognitive health through its intuitive psychological dimension.

According to reviewed studies, several priorities emerge: ensuring safe and comfortable visual conditions, facilitating visual access to the outside world while maintaining privacy, enhancing indoor air quality, and reducing energy costs without compromising user satisfaction or spatial health (Dudek, 2000; Haridi et al., 2022). While various studies have addressed daylight in schools, a knowledge gap remains in calibrating human lighting needs against light penetration depth in educational environments. This research seeks to address that gap by analyzing Sama schools at Bojnord Azad University. Hence, the primary research question is: What are the perceptual components of daylight in contemporary educational architecture that can inform effective design solutions?

Theoretical Foundations

Applications of light in education

Light is very important and important because of the effects it has on human mood and emotions, have you ever thought that paying attention to the right light has an effect on the learning and development of students? It may sound strange, but proper lighting is considered a powerful learning tool. Today, when you walk into many classrooms, you'll notice fluorescent lights lining the ceiling. Despite advances in lighting technology, these historic lights still exist. Unfortunately, the flickering of fluorescent lamps is not only about students' stupidity, but also about their emotions. Exposure to sunlight can improve learning (Barrett et al., 2015). Light does not allow us to see the world around us. Parts of our eyes are directly connected to parts of our brain and affect hormones related to sleep or alertness. When we think of being awake and productive, we think of yellow light as the best sunlight for us, when in reality, it's the blue light that comes from the sun in the morning that wakes us up and ready for the day. Remember that

not all light is created equal, and people are more alert and sleep less when exposed to blue light than other wavelengths. Sunlight, full-spectrum light sources, and most digital displays contain blue light. Light is an important element in creating a target. Students in brightly lit rooms have higher grades than students in dimly lit rooms. Research shows that low light reduces the effectiveness of information in the brain (Westwood et al., 2023).

On the other hand, dim lighting can affect learning because it is more difficult to see words when reading new information. This can cause wrong information to enter the brain or affect new stored information (Hamelin et al., 2023). Psychologists found that when a person spends most of his time in a room, lighting can affect his mental health. Doctors use bright light to improve depression, and on the contrary, if you are in a room with low light, it will have a negative effect on mood and depression. Also, people who suffer from depression will have difficulty concentrating and doing things. The results showed that women perform better in warm environments with white light, while men perform better in cool white light. Men and women both perceive and respond differently in evaluating the brightness level and light color index, so the mood of each gender is also different (Higuchi et al., 2021).

Application of light in the architecture of educational spaces

Adequate attention and sleep have a significant impact on cognitive skills such as concentration and memory. Temperament can determine the intensity of these cognitive abilities. Mood can be affected by the quality and quantity of light, for example, light is a successful remedy for seasonal problems and other non-seasonal psychological problems such as depression and eating disorders. Sleep stability is optimized when the sleep time is consistent. Melatonin secretion. People who sleep during peak melatonin sleep more than people who are awake during peak melatonin. Light plays an important role in evoking emotions. It can be used to create artificial environments and create environments that affect people's emotions. In addition, the user's well-being can be directly affected by light. Color brightness and time are the parameters used to create light conditions which are related to these topics. Since light has a profound effect on many levels of human performance, such as brightness, heart rate, and its indirect effects, the effect of light on classroom learning cannot be ignored. Several studies have investigated how the quality and color of light can impair people's visual abilities or improve their academic performance (Westwood et al., 2023).

Vision problems can cause behavioral problems in students. Additionally, new research examines how artificial light in the school environment affects children's performance, motivation, and concentration. Children's performance in overcrowded classrooms has decreased by 1 percent compared to their regular classrooms, and educators in general should be aware that the environment is never neutral. Creating uniform light on horizontal and vertical surfaces is one

of the basic requirements of an educational space. Appropriate and intelligent use of light according to the needs of the mentioned space will improve people's learning level. The use of intelligent and controllable lighting systems allows teachers to use the available facilities in this field to create a suitable environment for teaching (Dudek, 2005).

Ecology of educational space for lighting system design: due to the ever-increasing increase in energy costs, the issue of the amount of energy consumed has become significantly important. One of the best ways to manage energy consumption costs is to use tools with the appropriate energy consumption category. Reducing energy consumption in lighting systems is achieved by using daylight and using light sources with appropriate color temperature (the psychological effect of light color on people to create a cold and warm environment and control temperature). On the other hand, the combined use of high-efficiency lights and intelligent control systems to create a space with optimal and efficient lighting will bring a significant reduction in energy consumption (Haridi et al., 2022).

Ergonomics of the educational space for the design of the lighting system: the ability to concentrate, proper performance, and the feeling of freshness and well-being are highly dependent on people's physiology. Also, the physiology of people is also influential in the learning process. The effect of light on human health is undeniable, and this means that the importance of lighting quality is increasing and this feeling is enriched when the lighting design is based on the type of activity carried out in the space. Proper lighting is one of the basic prerequisites for focusing on reading and writing. This issue can also have a significant impact on the teaching and learning process (Dudek, 2000).

New lighting technologies in educational spaces: The use of new technologies has a significant impact on updating educational spaces. The automation of many tasks, in addition to creating more comfort for people, has also led to improvements in energy consumption. Creating change and adaptability of new technologies has helped to create a suitable educational environment. For example, the lighting system of educational spaces has created these conditions so that by pressing a button, the necessary changes are made based on the environmental conditions (Barrett et al., 2015). In other words, the use of a simple and efficient lighting control system allows students to have the ability to change the lighting, and by using a simple controller, the appropriate scenario for the space and activity can be selected. On the other hand, the use of intelligent systems with the ability to change the color temperature based on the needs of the space, based on the color temperature pattern of sunlight during the day, can affect the hormonal changes of the human body, which ultimately leads to an increase in student productivity (Lin et al., 2022).

Daylight and its effect in the educational environment: due to the characteristics of sunlight such as uniformity, creating a sense of vitality and its high quality, there is no substitute for this

light source. In addition, daylight regulates the body's biological activity like a timer. This light creates comfort, freshness and well-being, increases productivity and is a bridge to communicate with the outside environment (Dunster et al., 2023). Using the features of daylight along with an intelligent lighting system and at the same time preventing the creation of unpleasantness and heating of the space is an effective way to provide lighting. The following images show an example of a smart lighting system (controller, curtains and sensors) along with the use of daylight during the day. This issue has had a significant impact on improving the quality of learning, health and increasing students' ability to concentrate. On the other hand, the use of daylight is a strong lever to reduce the energy consumption of the lighting system. The example of the smart lighting system shown on the next page reduces the annual energy consumption by more than 50% (Higuchi et al., 2021).

Lighting of corridors and movement paths in educational centers: Most schools and educational spaces need lighting in movement paths all day long. The best way to reduce energy consumption in these spaces is to use a smart control system and sensors at the same time. Lighting sources are turned on and off automatically through presence sensors. This has caused the light of different parts and rooms to be provided without wasting energy. On the other hand, this issue makes it easy for people to find their way even in emergency situations, which is also done by means of emergency signs and based on the necessary standards. In other cases, the emergency exit light can also be used (Dudek, 2005).

Conference hall lighting: Conference halls and gatherings are a focal point for communication. Schools have always been considered as suitable hosts in this field, and lighting has a significant effect on increasing the level of pleasantness and hospitality. Light has the ability to divide large spaces into smaller parts. The use of an intelligent system and proper lighting design makes it possible to depict events with full beauty by changing the intensity and angle of light. By using glare-free lighting sources, it is prevented from creating visual harassment for the speaker or the actors (Haridi et al., 2022).

The lighting of the dining room and cafeteria: one of the stimulating factors in appetite is light. Dining halls and school cafes host students during breaks. The lighting of these spaces has a great effect on creating freshness and relieving fatigue. The use of light sources with a high color rendering index creates differentiation and this is also effective in increasing desire and appetite. Due to the fact that a lot of communication between students takes place in this space, the quality of light is of particular importance. Uniform lighting using direct and indirect lighting creates a unique effect in the display of furniture and space. The use of suitable lighting equipment and intelligent control systems plays a significant role in interaction with architecture to create a pleasant atmosphere (Ceppi & Zini, 1998).

Lighting of sports halls: educational complexes and schools are equipped with large sports halls with various facilities. Considering the differences in different sports fields, the lighting system of educational spaces in these places should have the ability to adapt according to the sports activity. They should be able to create different levels of brightness (Clark and Moss, 2001). One of the suitable solutions for the optimal use of sports halls is the use of intelligent lighting systems in such a way as to create the ability to provide the amount of lighting for various sports activities. Experience has shown that it is more useful to use lights resistant to the impact of sports balls and to use fluorescent lighting sources or high-pressure gas discharge in such spaces (Higuchi et al., 2021). Daylight is considered one of the most important factors influencing the quality of educational spaces, with extensive impacts on users' perceptual and therapeutic dimensions (Mohammadzadeh et al., 2025). The results show that human dependence on light and brightness is undeniable. Light not only has a direct effect on the human psyche, but also indirectly plays a role in regulating daily activities, sleep and wakefulness, and the body's energy levels (Mohammadzadeh et al., 2025).

Therapeutic components of daylight in educational spaces

The therapeutic components of daylight in educational spaces are as follows (Westwood et al., 2023):

1. Age: Usually, children like bright and pure colors and adults like mature and complex colors.
2. Place of residence: the type of geographical environment such as being mountainous, desert and coastal, sunny or cloudy areas are effective in choosing the color, especially the color of clothes. For example, northern and rural women use floral dresses and Alvan due to the always green environment.
3. Seasons: The use of dark color in winter to absorb the heat of the sun and light color in summer is of interest to people.
4. Community culture: The choice of color also depends on the social, psychological and cultural characteristics of the community, for example: Indians increase their resistance, standing and strength by mixing and coloring their skin.
5. Intelligence and emotional field: the health of the body, soul and mood of people is effective in choosing colors.
6. Social class: urban people usually use cold colors such as green and rural people use warm colors such as: red or saturated and Alvan motifs.
7. Social class in terms of income: low-income people choose bright and sharp colors, and high-income people choose light, complex, soft and delicate colors.

From the studies that have been carried out on the behaviors and social norms in Germany, it has been determined that although this country was involved in the Second World War for only 6 years, it took about 20 years for the different strata of the German society to completely remove

the dead colors. pour and choose warm and vivid colors as a factor to achieve beauty and prosperity of lively life. They even say that the manufacturers of those days by offering fabrics in yellow, orange and red colors that had positive, restless and exciting properties, in order to not be welcomed by the people They went bankrupt, and this factor caused studies, and finally they chose and replaced the gray color and gradually brought other colors into the scene and exposed them to the public.

In Iran, the purple color, which is a mixture of blue and red, respectively peace and tranquility, war and excitement, was exposed after the 8-year war. In the operating rooms, the drops of blood on the white clothes of the surgeons had a direct effect on the senses and the psyche, so they replaced it with green, which helped the success of the surgeries to a certain extent, because the color of the blood on the green became gray, causing not so much concern as the red color. It does not. It goes without saying that colors have weight, taste and shape; Even in humans, they sometimes cause creativity and talents. The great German musician Wagner was fond of red, the famous poet Goethe was fond of blue, and Scarwild was fascinated by yellow (Lin et al., 2022).

Medieval doctors in China and the Middle East used red light in the treatment of smallpox and eczema infections such as measles and scarlet fever and many skin diseases, and in the early 20th century, Russian and German doctors used the perceptual effect of blue and violet lights on the light of allergies. confirmed. In education, a light blue or greenish yellow classroom has far more effects than a classroom with gray walls, or a book with true colors is better than a book with black and white pictures (Barrett et al., 2015).

Principles of designing future educational spaces

In the design of educational spaces, principles, laws, and regulations must be considered, especially those related to building safety and spatial security (CABE, 2010). Standards for school construction should be observed, and the aesthetic aspects of educational environments should not be neglected. The physical, mental, emotional, and social development of students requires spatial conditions aligned with their growth needs, which can be achieved by applying architectural design principles tailored to children's psychological and physical traits (Dudek, 2000).

Attractive environments:

Emerge from the interaction between individual perceptual criteria and environmental features, fostering a sense of belonging and emotional engagement. Children’s drawings reflect their understanding and interpretation of spaces in great detail, indicating their deep perceptual involvement as users (Clark & Moss, 2001).

Orderliness and mental security:

Kevin Lynch (1960) emphasizes that a clear and legible environment provides psychological comfort, helping individuals to identify, remember, and organize environmental components meaningfully. A coherent and ordered space increases feelings of security and belonging.

Playground design:

It is vital to children's physical and mental growth. Outdoor play areas, as the first independent interaction space for children beyond their homes, must address their developmental needs and offer a secure yet stimulating setting (Frost, 2010). Features such as color, texture, and spatial form influence how children perceive and learn from their surroundings (Moore, 1996).

Diversification of the educational environment:

Supports multi-sensory learning. By incorporating various textures, colors, and sounds, designers can engage children's sight, hearing, and touch to deepen experiential learning (Dudek, 2005).

Appropriate flooring:

Helps define spatial boundaries and identities. Materials and patterns in floor design can promote visual continuity and a sense of place, particularly important in spaces used by children (Olds, 2001).

Designing spaces based on behavioral patterns:

Involves aligning spatial features with children's physical mobility and psychological preferences. Spatial proportions and functionality should reflect children's movement patterns and ergonomic needs (Hertzberger, 2008).

Stimulating creativity:

Is one of the most fundamental roles of architecture in educational settings. Through thoughtful manipulation of form, texture, and material, designers can foster an environment that nurtures curiosity and imagination (Ceppi & Zini, 1998).

Aesthetics:

Tailored to age groups, create vibrant and emotionally engaging environments that stimulate interest in learning. Colorful and energy-filled spaces can uplift children's moods and reinforce their enthusiasm for education (Barrett et al., 2015).

Anthropometric compatibility:

Is essential in furniture design. Learning environments should align with children's body dimensions and developmental abilities, offering ease of use and autonomy (Montessori, 1967).

Properly scaled furniture such as chairs, shelves, faucets, and toilets ensures comfort and encourages independent exploration.

Climate adaptability and cultural assimilation:

Critical for creating context-sensitive designs. Regional climate conditions, local culture, and economic realities should inform architectural choices, ensuring that students feel rooted in their environment, both physically and symbolically (Kraftl, 2006).

Research Questions

1. What is the evaluation model of the therapeutic components of daylight in educational spaces in order to develop architectural strategies?
2. How does sensitivity analysis of criterion weights affect the prioritization of the therapeutic components of daylight in educational spaces?

Research Method

This study is applied in terms of its purpose and quantitative in terms of its methodological approach. The initial weights assigned to the nine therapeutic components of daylight were adopted from a previous study in which the Analytic Hierarchy Process (AHP) was used to determine their relative weights. In the present study, these weights were used as the baseline for a scenario-based sensitivity analysis. The weight assigned to serotonin production was varied across alternative scenarios, and the resulting rankings were compared with the baseline ranking to examine how changes in its weight affected the relative prioritization of the therapeutic components.

Table 1. Therapeutic Components of Daylight and Their Design Implications in Educational Spaces

No.	Main Indicator	Therapeutic Role in Educational Environments	Factors Influencing Daylight Performance	Architectural Considerations	Suggested Applications in Educational Spaces
1	Sleep Cycle Regulation	Supports circadian rhythm alignment and regular sleep patterns	Timing and duration of light exposure	Providing adequate access to natural light during the early hours of the day	Classrooms, study areas
2	Depression Treatment	May contribute to mood improvement and the alleviation of seasonal affective disorder symptoms	Light intensity, duration, and timing of exposure	Increasing access to daylight and providing means to control its entry	Learning spaces, counseling rooms
3	Nervous System Stimulation	Helps regulate alertness and cognitive responses	Timing and intensity of light exposure	Providing natural lighting appropriate to the activity and time of use	Classrooms, educational workshops
4	Serotonin Production	Plays a role in mood regulation and feelings	Timing and amount of daylight	Ensuring adequate access to natural light	Rest areas, communal

		of well-being	exposure	and well-lit spaces	spaces
5	DNA Activity Enhancement	Potentially relates to cellular biological responses to light exposure	Wavelength and spectral characteristics of radiation	Considering the spectral characteristics of light and avoiding broad claims about its effects on all cellular processes	Spaces with controlled access to natural light
6	Vitamin D Synthesis	Ultraviolet B (UVB) radiation from sunlight contributes to vitamin D production in the skin	Degree of skin exposure to UVB radiation	Distinguishing indoor visible daylight from UVB exposure, as ordinary glazing blocks much of the UVB radiation	Courtyards and outdoor educational spaces
7	Immune System Strengthening	Some light-related biological processes may be associated with immune function	Timing and pattern of light exposure and circadian rhythm regulation	Providing sufficient daylight while maintaining thermal and visual comfort	Communal spaces, rest areas
8	Stress and Anxiety Reduction	May promote psychological comfort and reduce perceived stress	Light quality, glare, and visual connection with the outdoors	Controlling glare and establishing appropriate visual connections with nature and outdoor spaces	Rest areas, counseling rooms, study areas
9	Eye Health Support	Helps provide appropriate visual conditions and reduce visual discomfort caused by inadequate lighting	Illuminance, light distribution, and luminance contrast within the field of view	Designing uniform lighting, controlling reflections and glare, and incorporating suitable shading devices	Libraries, classrooms, study halls

Mohammadzadeh et al. (2025) employed the Analytic Hierarchy Process (AHP) to determine the relative importance of therapeutic daylight components. The results indicated that serotonin production received the highest priority, with a weight of 0.14, followed by sleep cycle regulation, with a weight of 0.13. Seasonal affective disorder (SAD) treatment and stress and anxiety reduction each received a weight of 0.12. In contrast, DNA activity enhancement and eye health support ranked lowest, with weights of 0.09 and 0.08, respectively. These findings highlight differences in the relative priorities assigned to the therapeutic components of daylight within the study's evaluation framework (Mohammadzadeh et al., 2025).

Table 2. AHP results (Mohammadzadeh et al., 2025).

Sub-Criterion	Final Weight
Serotonin Production	0.14
Regulation of Sleep Cycles	0.13
SAD Treatment	0.12
Stress and Anxiety Reduction	0.12
Nervous System Stimulation	0.11
Vitamin D Synthesis	0.11
Immune System Enhancement	0.10
DNA Activity Enhancement	0.09
Eye Health Support	0.08

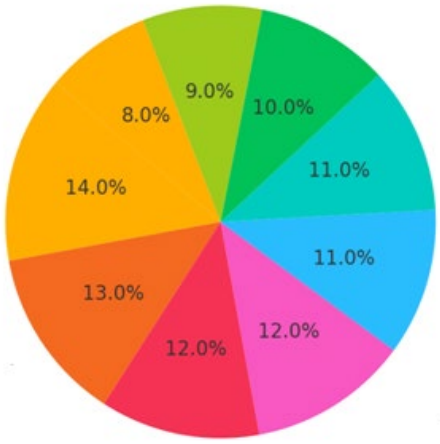


Figure 1. Final weighting of sub-criteria of treatment components.

Sensitivity Analysis of the Weights and Priorities of Therapeutic Daylight Components

To assess the robustness of the prioritization of therapeutic daylight components in educational environments, a scenario-based sensitivity analysis was conducted by varying the weight assigned to serotonin production. The analysis aimed to examine how changes in this component's weight influence its relative ranking and the prioritization of the remaining components. The initial weights derived from the reference study employing the Analytic Hierarchy Process (AHP) were used as the baseline for comparison.

Table 3. Initial Weights of Therapeutic Daylight Components

No.	Therapeutic Component	Initial Weight
1	Serotonin Production	0.14
2	Sleep Cycle Regulation	0.13
3	Depression Treatment	0.12
4	Stress and Anxiety Reduction	0.12
5	Nervous System Stimulation	0.11
6	Contribution to Vitamin D Production	0.11
7	Immune System Strengthening	0.10
8	DNA Activity Enhancement	0.09
9	Eye Health Support	0.08
	Total	1.00

As presented in Table 3, serotonin production has the highest initial weight (0.14), followed by sleep cycle regulation (0.13). Depression treatment and stress and anxiety reduction share the next priority, with weights of 0.12 each. Nervous system stimulation and contribution to vitamin D production have weights of 0.11, while immune system strengthening, DNA activity

enhancement, and eye health support have weights of 0.10, 0.09, and 0.08, respectively. The initial weights sum to 1.00, providing a consistent baseline for the subsequent analysis.

Sensitivity Analysis Procedure

Serotonin production was selected as the focal component because it received the highest initial weight. Two alternative scenarios were established by reducing its weight from 0.14 to 0.13 and 0.12, respectively. To maintain comparability across scenarios, the weights of the remaining eight components were adjusted proportionally, ensuring that the total weight remained equal to 1.00.

For each scenario, the adjusted weights of the other components were calculated by multiplying their initial weights by an adjustment factor. This factor was obtained by dividing the total weight remaining after assigning the revised weight to serotonin production by the sum of the initial weights of the other eight components. The resulting weights were then compared to determine the revised relative rankings.

Table 4. Sensitivity-Analysis Scenarios for Serotonin Production

Scenario	Weight of Serotonin Production	Adjustment Factor for Other Components	Resulting Rank
Baseline	0.14	1.0000	1st
Scenario 1	0.13	1.0116	2nd
Scenario 2	0.12	1.0233	4th

Analysis and Interpretation

In Scenario 1, reducing the weight of serotonin production to 0.13 increases the weights of the remaining components proportionally. Consequently, the adjusted weight of sleep cycle regulation rises from 0.13 to approximately 0.1315, exceeding the revised weight of serotonin production. Serotonin production therefore moves from first to second place.

In Scenario 2, reducing the weight of serotonin production to 0.12 increases the adjustment factor for the other components to approximately 1.0233. The adjusted weights of sleep cycle regulation, depression treatment, and stress and anxiety reduction become approximately 0.1330, 0.1228, and 0.1228, respectively. These three components consequently rank above serotonin production, placing it fourth under this scenario.

The results indicate that the relative ranking of serotonin production is sensitive to changes in its assigned weight under the specified proportional-adjustment procedure. However, this finding should be interpreted within the scope of the scenarios examined and the assumption that the other component weights change proportionally.

The sensitivity analysis demonstrates that modifying the weight of serotonin production can alter its relative position within the prioritization framework. This finding highlights the

importance of examining the influence of weighting assumptions when interpreting AHP-based priorities. Nevertheless, the results reflect relative importance within the evaluation framework rather than direct evidence of therapeutic effectiveness.

Analysis of Research Findings

The results of the reference study using the Analytic Hierarchy Process (AHP) indicated that serotonin production, with an initial weight of 0.14, was the highest-priority therapeutic component of daylight. Sleep cycle regulation ranked second, with a weight of 0.13, while depression treatment and stress and anxiety reduction followed, each with a weight of 0.12. Nervous system stimulation, with a weight of 0.11, was also among the important components. These findings suggest that psychological well-being and sleep regulation received considerable relative importance within the evaluation framework.

In the present study, scenario-based sensitivity analysis was conducted to examine the stability of the prioritization results, focusing on serotonin production. Its initial weight of 0.14 was adopted as the baseline value, and alternative scenarios were developed by varying this weight. The resulting rankings were compared with the baseline configuration to investigate whether changes in the relative weight of serotonin production affected its position and the prioritization of the other therapeutic components. This approach provides a framework for evaluating the robustness of the initial rankings. However, conclusions regarding ranking changes require recalculating the weights and priorities for each scenario.

Summary and Conclusion

This study investigated the therapeutic dimensions of daylight in educational environments, emphasizing their relevance to architectural design. Based on the initial weights adopted from the reference AHP study, serotonin production ranked first, followed by sleep cycle regulation. Depression treatment and stress and anxiety reduction shared the next priority. These findings highlight the importance of considering daylight-related therapeutic components when designing educational environments that support users' health and well-being.

Scenario-based sensitivity analysis was used to investigate the stability of the initial rankings by varying the weight assigned to serotonin production and comparing the resulting rankings with the baseline. This approach can help determine whether the relative priorities of the therapeutic components remain stable under different weighting scenarios and can support more informed architectural decision-making.

Overall, the findings emphasize the importance of incorporating natural daylight into educational design, including appropriate daylight access and glare control. Nevertheless,

definitive conclusions from the sensitivity analysis require recalculating the weights and rankings for each scenario. Furthermore, AHP weights represent the relative importance of components within the evaluation framework and do not independently establish their therapeutic effectiveness. Further research across diverse cultural and climatic contexts is recommended to assess the applicability of these findings.

Author Contributions

The author has done the conceptualization of the article and writing of the original and subsequent drafts.

Data Availability Statement

Data available on request from the author.

Ethical considerations

The author avoided data fabrication, falsification, plagiarism, and misconduct.

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Conflict of interest

The author declare no conflict of interest.

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