



# INTERIOR DESIGN OF INTERNATIONAL SCHOOL ELEMENTS AND STUDENT PERFORMANCE

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## ABSTRACT

Schools are the first place most people go to learn. To the eye of students, schools are more than only buildings; they are the gateways to a world of wonder and discovery. To make this experience unforgettable and more beneficial, this study investigates the impact of international school interior design on student performance across various design factors. In an era known for rapid technological advancement, the physical infrastructure of educational institutions has evolved to innovate design progress. This research explores the theoretical bases that have different phases of the relationship between international school interior design and student academic outcomes, examining several environmental behavior principles such as naturalness, individualization, and stimulation through a comprehensive review of existing literature and data analysis.

Research problem: While some prior studies have connected student behavior to the interior design elements of the learning space, no comprehensive, integrated study exists to inform university educational space design in a way that maximizes student efficiency.

Research Objective: Sheds light on how interior architect design affects student engagement, motivation, and overall achievement. Establish standards for

Evaluating the learning space indicates whether or not it can offer a suitable learning environment that benefits students' physical and mental health.

Research methodology: This approach relied on a review of prior theoretical and practical studies to gather sufficient information to determine the criteria for evaluating each educational space element and its impact on students.

**KEYWORDS:** *International school Design, Classroom Design, Learning Impacts, Interior design, Environmental Design.*

## 1. INTRODUCTION

The [1] declares that the design characteristics emphasized within the humanization framework are essential for the international school facility factors, such as the level of maintenance, lighting, colors, noise, temperature, and air quality. These factors impact students' psychological well-being, sense of security, and physical health. In the same way, according to Gifford's general framework, humanization design elements can be incorporated into the "physical features of the learning environment" that influence students' attitudes toward learning, such as their desire to learn and satisfaction with their international school experience, and related behaviors, such as performance and participation [1]. Several studies focused on the effect of space design on the human senses and brain. A positive classroom recently refers to a setting where students come to

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class prepared to learn, work hard to grasp academic requirements, especially those in math, science, and reading, go home and correctly complete their homework, and come back the following day eager to learn more [2] In their research, [3], focused on considering the issue of naturalness, individualization, and stimulation level during space design. In addition, the study shed light on the necessity of creating spaces that could provide a sensory environment for people, which could help them reach their maximum possible potential.

## 2- BASIC INTERNATIONAL SCHOOL DESIGN ELEMENTS INFLUENCING STUDENTS’ PERFORMANCE:

1. Naturalness
2. Light
3. Links to nature
4. Individualization
5. Flexibility
6. Connection
7. Complexity
8. Colour



Fig.1 The Hongling Experimental Primary International School[31]

### 2.1 Naturalness

Naturalness is the essence of being natural or rooted in biological principles. The principle of Naturalness relates to the environmental parameters that require physical well-being: sound, light, air quality, temperature, and link to nature [4]. This study focuses more on the factors related to design, which are light and linked to nature. Students in the learning environment have specific requirements. Natural daylight regulates the cycle of wake/ sleep [5]. In the classroom, natural and artificial lights are equally important. [6] Ideal lighting conditions are achieved by formulating the light parameters using the best natural and artificial light quality while avoiding direct sunlight. Helping students connect with

### 2.2 light

Natural daylight has a higher chance of optimizing visual performance than artificial light, as it is typically provided in large quantities and has a spectrum that guarantees higher color rendering [4].

Also, a study by the Hescong Mahone Group discovered that students receiving high levels of natural light achieved test scores up to 18% higher than those receiving minimal natural light [42]. Fig.2

However, natural and artificial light efficiency depends on the delivery method, linking to glare issues and disturbance [4]. The quality and quantity of natural light in a classroom significantly impact student's performance. Studies found that light has a significant influence on students' performance. Students not absorbed by intense sunshine or uncomfortable lighting conditions are better at focusing, which is reflected in their studies more effectively [7, 8]. An adequately lit classroom with sufficient natural light can improve student mood, focus, and overall well-being and enhance academic performance.

This is proven by [9] a study that concluded that students who received the most daylight advanced in mathematics and reading 20% and 26% quicker than kids who received the least.

Several design principles can be used to reach the best gain of sunlight. Considering classrooms in the east and west directions, the daylight received at the school has a low glare risk. These classrooms can be designed with windows of a larger size. Selecting more oversized windows in orientations that do not have direct sun reduces glare and ensures a more comfortable and productive learning environment [7]. Additionally, optimizing the glazing area of the floor enhances these points' effectiveness. On the other hand, addressing shading covering control by introducing high-quality blinds enhances the capacity to manage natural light, reducing glare and ensuring an ideal learning environment.

Enhancing light quality in classrooms is a critical step toward improving students' performance, and it can be achieved through a multilayered approach. Adjusting the degree to which lighting levels can be controlled is crucial. Studying the different lighting requirements that can be tailored to various learning activities fosters a more adaptable and comfortable environment and minimizes student distractions. [8], studied some design solutions that use artificial and natural light to reach that goal. Considering the quality of electrical lighting is essential and can affect students' performance. Using more electrical lighting of higher quality can create a better visual environment. This can significantly reduce eye strain and create a more conducive atmosphere for learning. Moreover, strengthening natural and artificial lighting quality is equally important [9]. Controlling natural light sources and implementing advanced artificial lighting can create an environment that maximizes students' focus and well-being. By incorporating these elements, schools can create classrooms optimized for lighting quality, leading to better concentration and overall academic performance among students.



Fig.2 International school campus Grimisuat, Switzerland



### 2.3. Links to nature

Some psychological benefits of the natural views are scientifically proven, such as prompting relaxation and reducing stress. Furthermore, being in nature can encourage creativity, improve well-being, and increase the connection with nature, which directly influences mental health. [11].

Researchers have found that children benefit significantly from nature experiences due to their mental plasticity and vulnerability [13, 14].

The connection between access to nature and mental attention is a growing interest. [14]



Fig.4 AIKO Educational Institution( plan) [31]

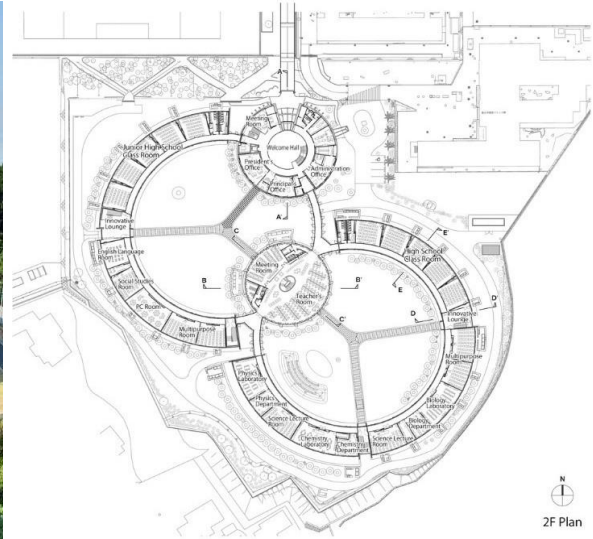


Fig.3 AIKO Educational Institution(exterior) [31]

found that exposure to natural green environments improves children's mental attention. There is a correlation between students' learning progress and wooden furniture and dedicated outdoor play areas. [8], Their research considers two key factors when evaluating the degree to which students can access natural elements. Firstly, access to nature can be facilitated by having a door that leads directly to the outside, providing an opportunity for students to connect with the outside and where natural spaces are located Fig.3, Fig.4. Secondly, it creates the feeling of bringing the outer natural spaces inside the classroom. This is by providing views of nature through classroom windows. Placing windowsills below a child's eye level, along with the presence of exciting and green views both near and far, can significantly influence the impact of nature on the learning environment Fig.5.

Links to nature, whether through window views or direct access to the outdoors, can demonstrate students' ability to affect individuals' well-being and learning progress. As we continue to understand these connections, there is a growing emphasis on integrating natural elements into the design and organization of spaces where people live, heal, and learn.



Fig.5 Joliot-Curie International School Catering Service and International School Life Center [32]

## 2.4. Individualization

The concept of individualization centers on tailoring settings and experiences to each person's or group's unique needs. Individualization in space design refers to making areas that can be altered to meet the needs and tastes of users, fostering a feeling of control and customization. In general, individualization aims to improve experiences by recognizing and classifying the distinctive qualities of every individual, whether in educational, residential, or professional settings. The concept of individualization in education refers to how well a classroom is made to meet the unique needs of a particular set of students.

Two important factors are included in this study's discussion of individualization: flexibility and connection. This focus area seeks to provide a specially constructed environment that best facilitates students' behavior and learning processes, ultimately leading to improved student performance. For example, private and customized areas have been suggested to improve memory, recall, and information absorption [16]. [17] emphasizes how vital flexibility is as a fundamental design need, accommodating a range of user wants and activities. References [9, 6] support the idea of Individualization by emphasizing the improvement of space utilization and performance metrics that result from clearly defined pathways to activity areas.



## 2.5.Flexibility

Assessing flexibility involves how well a classroom caters to the unique needs of different age groups and adapts to evolving educational methods. While minor adjustments to the physical environment may not significantly impact learning outcomes, the overall architectural design of classrooms plays a crucial role in students' academic achievement, health, and well-being. A flexible classroom, which supports various learning modes, fosters a dynamic educational experience. Designing flexible classrooms should align with specific educational objectives and teaching strategies.

Several methods can be integrated into a classroom that results in flexible spaces, such as introducing a clear breakout zone, providing accessible and good storage area that does not disturb class useful spaces, and creating a different floor plan for other activities, which suites younger students who need to be engaged in creative play-based activities. Larger classrooms and suitable furniture types could help reach the classroom's flexibility. While the acceptability of flexible learning environments is relatively high and teachers and students report perceived benefits to teaching, learning, and well-being [19], few studies have observed flexible learning spaces in use or have systematically documented student behavior to determine the impact that flexibility of space and mobility of furniture has on space use [20]. [21] presented flexible learning rooms, Fig 6 featured a student-centered, group-focused teaching methodology. This method of instruction, along with the accessible furniture, gave students chances and incentives to walk around during the class. Students were free to decide where in the room to work, what resources to employ, and how to organize their groups or work individually. They typically formed groups or worked independently of their own volition.

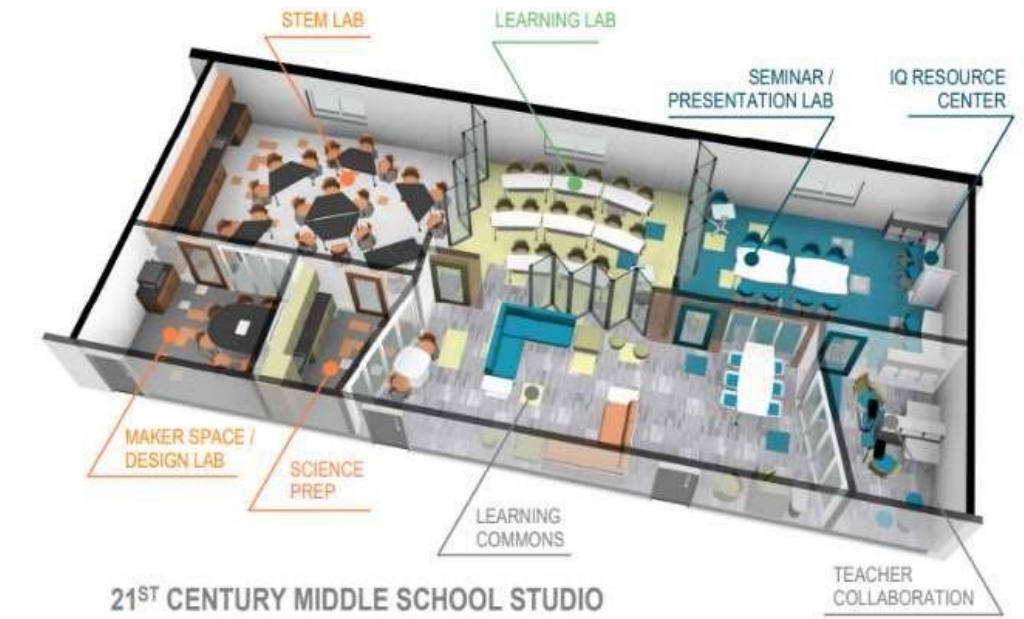


Fig 6. The phenomenon attributed it to the difficult social come with the transition from childhood [21]



Fig 7 Fig 8

Fig.7, Fig 8 Lan-Tian Elementary International school (contains a curved wall that provides the dual function of both privacy on the interior side and book storage on the exterior side of the room.)[33]

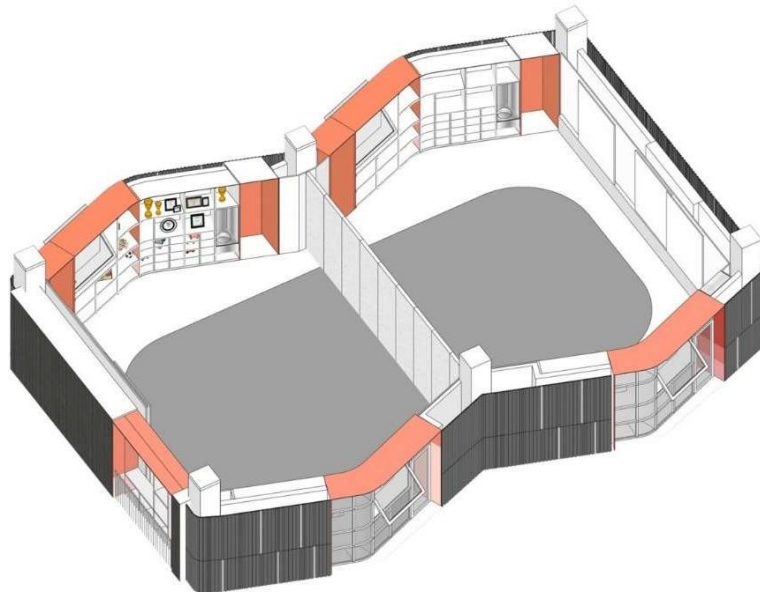


Fig.9 Lan-Tian Elementary Library (Isometry)[33]

As with coworking spaces, students also benefit from open, fluid classroom layouts. The ability to move furniture around and create spaces that accommodate different types of learning provides a flexible environment to suit the needs of various students at various times Fig.7, Fig.8. Lan-Tian Elementary International School by Studio In2 contains a curved wall that provides the dual function of both privacy on the interior side and book storage on the exterior side of the room Fig.9. The Hongling Experimental Primary School, mentioned earlier, contains drum-shaped plans that allow for multiple configurations of the classrooms Fig.1.

A flexible learning environment has several benefits [22]

Flexibility: to improve all instructional objectives and methods.

Adaptability: by supporting all teaching and learning methods and styles.

Interactivity: This is by giving students a chance to communicate and collaborate.

Functionality: This allows endless gathering spaces that configure teaching and learning.

Intentionality: providing clear instructions to full class members in groups or individuals.

Creativity: This is by developing students' engagement in class activities.

Activity: to encourage active and movement learning.

In conclusion, flexible learning environments benefit both students and teachers. They are fundamental to a teacher's ability to adapt the classroom to meet various needs and achieve learning objectives.

### 2.6.Connection

Connection examines how easily students can integrate with the broader international school environment. Connection, particularly regarding pathway design, plays a critical role in the educational environment Fig.10. Research by [8] highlights the significant impact of movement and circulation on reading comprehension. Additionally, the width of corridors and the presence of orienting objects with identifiable destinations can significantly affect the learning experience. The wider the corridors, the better the potential for improved learning outcomes [8]. Fig.12&13



Fig.10 Lan-Tian Elementary International School (Isometry)[34]

Furthermore, orienting corridors with displays, landmarks, and access to natural light with views toward the outside can enhance students' sense of direction and engagement within the international school environment[6]. These elements are critical considerations in the design of educational spaces [23]. Fig11





Fig11.Lishin Elementary International School Library (Wood-framed shelves to create a book wall) [34]



Fig.12&13 Lishin Elementary International School Library connects the three classrooms with different functions. [34]

## 2.7.Complexity

Complexity measures how the components of a space interact to produce either a random and confused or visually cohesive and ordered environment. It has been asserted that learning requires intense concentration.

Since their capacity to actively maintain task objectives and disregard distractions is still developing and fragile, young children may find it particularly difficult to focus on educational environments [18].

[8] Solving complexity in a classroom is a multifaceted concept that significantly influences the learning environment. They mention that it encompasses various factors, such as the degree to which the classroom offers suitable visual diversity. This pertains to the arrangement of visual elements within the room and the intricacy of elements like the layout and ceiling coverings. It is essential for the room layout and displays not to be excessively cluttered or overly sterile. Furthermore, complexity extends to the degree to which shows in the classroom offer appropriate visual diversity

In summary, achieving the right level of complexity in a classroom, both in its physical arrangement and the materials displayed, is pivotal in creating a conducive learning atmosphere.

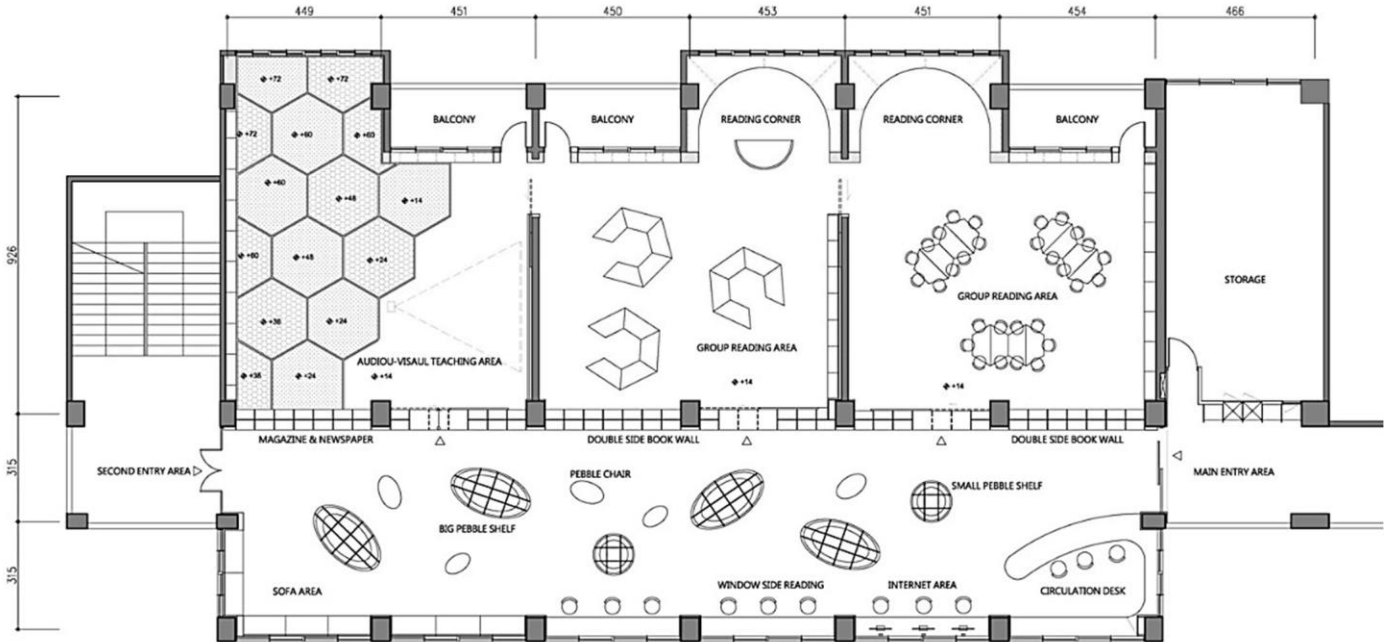


Fig 14 Lishin Elementary International School Library (plan) [34]

**Fig. 14** The library fills into space is a challenge for the international school reading team (consisting of teachers). So, this plan had a separate space concept for the school. First, to make sure the entry space (collaborative classroom corridor) becomes a charming reading area welcoming students, wood-framed shelves were created to create a book wall and pebble. Second, the three classrooms should be connected to different functions. Third, the original teacher's office should be opened into a reading corner. The wooden frame book wall curves onto the ceiling, and it looks like space is under a tree. Fig.12&13

## 2.8.Colour

Among various color systems, the Munsell Color System is globally recognized and standardized for its precision in distinguishing colors, as illustrated in Fig15. This system categorizes color characteristics based on how humans perceive colors through three fundamental attributes: type, value (brightness), and intensity (purity or saturation). According to its creator, Albert H. Munsell, these three qualities form a scale that defines colors [24]. The primary attribute is type, distinguishing one color tone from another, such as yellow from red or green from blue. Another color property is value, representing the degree of darkness or lightness in a particular color, ranging from total lightness (white) to complete darkness (black). The third property is saturation, which indicates the relative purity or intensity of colors. High-saturation hues have less gray tone, while more gray in the same value signifies increased saturation [24]. Fig.16

According to a color study, a space's color can affect mood changes that might influence performance. Some experiments found that some colors can directly influence people's senses and impressions. [24], categorizes colors depending on their effect on human psychology as follows: Light blue cooler, orange, or red presenting temperatures while high pitch and shrill effect on sounds. The appearance of an object can be affected by the color and saturation used. Dark colors can make the object appear heavier, while less saturated colors can make it seem less dense. Similarly, colors can also affect the perception of space.

Light or pale colors can make objects appear more prominent, while dark or saturated hues can make them seem more minor.

Some studies found that students' color preferences reveal that certain colors have specific positive effects on the skills of primary-grade children. More fabulous shades benefit international school concentration [3]. Unity and intensity of color, along with contrasting end walls, are also influencing [2].

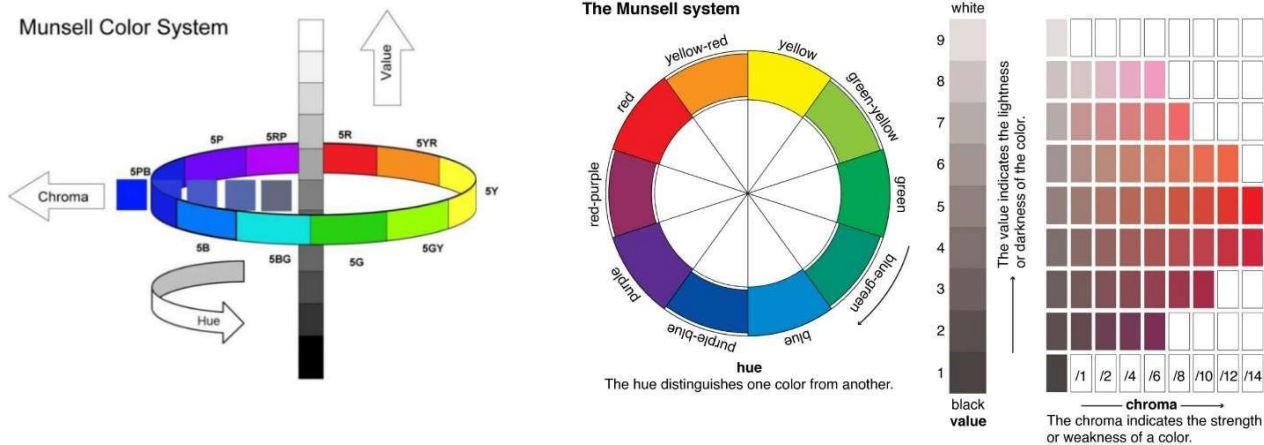


Fig 15. This study references the Munsell color wheel, a tool for understanding and communicating color [24].

Fig 16. Another representation of the Munsell color wheel is also used in this study [24].

These visual aids help illustrate the color theories and concepts discussed in this research.

[26] conducted a deep study that focuses on studying the impact of classroom color on students' performance. The study found that blue and orange had the most favorable influence on student's learning and behavior. Blue was found to enhance children's creative artistic skills, while orange and yellow were observed to support logical thinking, particularly in mathematics. Green and purple had a balanced impact on improving both logical and creative thinking. Classes with predominantly orange and green color schemes had a majority of highly skilled students in terms of learning. Additionally, the study identified a positive influence of blue on international school attendance. Consequently, the study unveiled the potential of using colors to create conducive learning environments aligned with the educational goals of primary education. Fig 2



Fig 16. modern educational institutions are focusing on color and design [26]

The University of British Columbia studied the performance of over 600 participants across six cognitive tasks that demanded either a focus on details or a creative approach. It was discovered that the color red enhanced performance on detail-oriented tasks like memory retrieval and proofreading, which are typically associated with left-brain thinking. In contrast, blue enhanced performance on creative tasks, typically associated with right-brain thinking.

In his book, [28] recommended using colors for children's schools. He noted that to fit children's nature, creating a visual learning environment characterized by warm, bright, yet slightly softened color schemes is advisable. Colors like light salmon, gentle warm yellow, pale yellow-orange, coral, and peach can complement their extroverted nature, ultimately helping to alleviate tension, nervousness, and anxiety. It is also recommended to incorporate accents of colors with a contrasting cool temperature, as



suggested by [29]. This can be achieved by harmoniously combining colors from two opposite temperature spectrums.

Table of color classification and example

Classification	Common examples	Its psychological effect on students	Its effect on their learning skills and tasks
Cool Colors	Green Blue Purple	<p><b>Positive effects</b></p> <ul style="list-style-type: none"> <li>• Promote relaxation and internalization [36].</li> <li>• Promote a calmer atmosphere [37].</li> <li>• Associated with liberty and transparency [38].</li> <li>• Green is the most calming to the eyes [35].</li> <li>• Blue can assist and calm overly energetic students [35].</li> </ul>	<p>It can stimulate a promotion concentrate to motivate individuals to attain favorable results, boosting creative jobs, particularly those that are blue [38], [39].</p> <ul style="list-style-type: none"> <li>• Compared to warm hues, cool rooms had a more favorable impact on "individual productivity" and "social adaptation" [39].</li> <li>• Children's IQs were raised, and classrooms stimulated their alertness and inventiveness by painting light blue, yellow, yellow-green, and orange [40].</li> </ul>
Warm Colors	Orange Yellow Red	<p><b>Positive effects</b></p> <ul style="list-style-type: none"> <li>• Excitement is produced by stimulating and increasing brain activity [36].</li> <li>• Yellow is associated with vitality, intellect, and expansiveness and stimulates the nervous system. In addition, it alludes to joy, impulsivity, activity, power, and dynamism [35].</li> </ul> <p>Orange is linked to kid activity because it embodies the traits of inventiveness, Brightness, extroversion, and liveliness [35].</p> <p><b>Negative effects</b></p> <ul style="list-style-type: none"> <li>• Aggression was impacted by red, as stated in [37].</li> </ul>	<ul style="list-style-type: none"> <li>• It has been determined that this color is the best in grabbing students' attention and motivating them to participate actively in events [38].</li> <li>• More adept at activities like memorization of crucial facts that need people's undivided attention [39].</li> <li>• It was discovered that classrooms painted with light blue, Yellow, yellow-green, and orange raised children's IQ levels while encouraging attention and creativity [40]</li> </ul>
Monotonous	Grey white	<p><b>Negative effects</b></p> <ul style="list-style-type: none"> <li>• Leading to fatigue and monotony [36].</li> </ul> <p>A rise in students' impatience and trouble focusing. It was discovered that both symptoms were harmful to the promotion of learning. [41]</p>	<ul style="list-style-type: none"> <li>• Regarding "social adaption" and "individual productivity," it is ranked worse than regions painted in warm and cool colors. [39].</li> <li>• Because white paint has a high light reflectance value, it restricts pupils' vision and produces distractions [41].</li> </ul>

### 3. CONCLUSIONS

- Numerous current educational facilities face issues with their interior design aspects. The inadequate lighting, ventilation, and temperature problems can be prevented right away from the start. Often, these problems arise from the improper layout of education, leading to low natural light levels, insufficient ventilation, and high temperatures due to poor airflow. This pushes us to rely on artificial methods to meet the required standards for these elements, ultimately raising energy usage and expenses and causing unforeseen outcomes. One key issue that can be prevented right from the start is noise. This can be accomplished by selecting a location away from noisy areas, helping to reduce external noise. Choosing soundproof finishing materials can also significantly decrease internal noise levels.
- Conversely, an easily avoidable yet commonly repeated problem is the use of white wall color. Numerous studies have shown the adverse effects on students and teachers, yet it remains prevalent. It is preferable to use warmer or cooler colors over white.
- Space size and seating arrangement are usually not problematic. Issues can typically be resolved by adjusting the number of students to fit the space and its intended activities.
- This study aimed to establish criteria for determining the optimal condition of each element based on its psychological, physical, and behavioral impact on students and delve into the intricate connection between international school interior design and student academic results. It zooms in on environmental behavior concepts like naturalness, individualization, and stimulation. It delves into how design influences student engagement, drive, and overall success, acknowledging the changing landscape of educational settings. The discoveries in this research carry substantial weight for educational decision-makers, architects, and designers tasked with molding the future of international school spaces. The interaction among design aspects, environmental factors, and student performance highlights the importance of crafting learning environments that meet students' mental well-being, contentment, and academic triumph.

## **4. Recommendations**

### **1. the Outdoors & Learn Outside**

- Joining students with nature boosts wellness and education.
- Ensuring that classrooms are oriented to minimize glare and harnessing the benefits of natural light can significantly impact student performance.
- It is suggested that schools consider designing outdoor play areas, providing nature views through windows, and arranging classroom elements to create a sense of being in a natural environment.
- Arrange classroom settings with focus and well-being.

### **2. Versatile Spaces for Diverse Learning Needs:**

- Personalize classroom settings to fit various teaching styles and student choices.
- The ability to customize the environment to suit students' and teachers' preferences and requirements enhances the learning experience.
- There should be an emphasis on providing clear instructions and promoting creativity and active learning.

### **3. Efficient Traffic Flow Patterns:**

- Creating pathways and circulation patterns within the international school environment can improve students' engagement and sense of direction.
- Wider corridors, orienting objects, and access to natural light can enhance the learning experience.
- Natural light in traffic areas enhances the overall learning atmosphere.

### **4. Visual Harmony & Diversity:**

- Maintain a balance between visual appeal and color variety.
- Avoid overcrowding while offering a mix of visual elements in classrooms.

### **5. color and complexity**

- significant roles in creating a stimulating learning environment. Striking a balance between visual coherence and variety is crucial. Classrooms should avoid excessive clutter while providing diverse visual elements.
- Design should consider the choice of colors and their impact on mood and performance. Different colors can influence students' emotions and physiological responses, and the selection of colors should align with the desired learning outcomes.
- When selecting colors for international school interiors, it is essential to consider the impact on students' performance. Research suggests that colors like blue and orange can favor learning and behavior. These colors can be integrated into the school's color scheme to create a conducive learning environment. Additionally, warm, bright, and slightly softened colors can align with the extroverted nature of children, helping reduce tension and anxiety.
- In summary, establishing the best possible learning settings requires an awareness of how interior design affects student performance. By implementing the principles above into international school design, stakeholders can positively influence students' motivation, engagement, and overall academic accomplishment. This will eventually help to shape education



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## التصميم الداخلي لعناصر المدرسة الدولية وأداء الطلاب

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### الملخص

تعد المدارس أولى أماكن التعلم لمعظم الناس، وبالنسبة للطلاب تعتبر المدارس أكثر من مجرد مباني بل هي بوابات للولوج لعالم العجائب واستكشافها. وسعيًا لجعل هذه التجربة لا تنسى وأكثر نفعًا تناولت هذه الدراسة تأثير تصميم المدارس على أداء الطالب بناء على عوامل التصميم المختلفة. شهدت البنية التحتية للمنشآت التعليمية في الحقبة التي تتميز بالتطور التكنولوجي السريع تطوراً بحيث ضمت تكنولوجيا تصميمية مبتكرة. يتناول هذا البحث الأسس النظرية للعلاقة متعددة الأوجه بين تصميم الديكور الداخلي للمدارس والمخرجات الأكاديمية للطلاب من خلال دراسة العديد من المبادئ السلوكية البيئية مثل الطبيعية والفردية والمحاكاة، ومن خلال الاستعراض الشامل للمراجع والأدبيات الموجوده وكذلك التحليل التجريبي للبيانات.

مشكلة البحث: بعض الدراسات السابقة قد ربطت سلوك الطلاب بعناصر التصميم الداخلي لمساحة التعلم، لكن لا توجد دراسة شاملة ومتكاملة للتصميم بطريقة تزيد من كفاءة الطلاب التعليميه في الفصول الدراسية وخاصة المدارس الدولية

هدف البحث: إلقاء الضوء على السبل التي تؤثر من خلالها تصاميم العماره الداخليه على مشاركة وتحفيز الطلاب وكذلك التحصيل الكلي لديهم ووضع معايير لتقييم مساحة التعلم التي تشير إلى ما إذا كان يمكن أن توفر بيئة تعليمية مناسبة تفيد الصحة البدنية والعقلية للطلاب أم لا.

منهجية البحث: اعتمد هذا النهج على مراجعة الدراسات النظرية والعملية السابقة لجمع المعلومات الكافية لتحديد معايير تقييم كل عنصر من عناصر الفضاء التعليمي، وكيفية تأثيره على الطلاب.

الكلمات الدالة: تصميم المدارس الدولية، تصميم الفصول الدراسية، تأثيرات التعلم، التصميم الداخلي، التصميم البيئي.

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