



## Evaluating Quality Of College Life (QCL) Via Space Syntax Analyses

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### Abstract:

This research addresses the concept of Quality of College Life (QCL), as it includes indicators to evaluate the quality of university life in terms of academic and social aspects, in addition to the quality of urban spaces and open outdoor spaces on campus. The studies classified a group of needs, which are based on the basic needs expanded by Maslow. This research focuses on the aspect of the structural relationships of the spatial configuration, and their relationship to the quality of college outdoor spaces. Many studies have identified the needs required to achieve this quality, on which this concept is based. Through the link between the compositional formation of external spaces and the impact on achieving those needs, the need to investigate the importance of analytical indicators of the rules of space analysis emerges.

**Keywords:** space syntax, Quality of College Life (QCL), spatial analyses, spatial configuration, Depthmap.

تقييم جودة الحياة الجامعية (QCL) من خلال تحليلات بناء الجملة الفضائية

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### خلاصة:

يتناول هذا البحث مفهوم جودة الحياة الجامعية (QCL)، حيث يتضمن مؤشرات لتقييم جودة الحياة الجامعية من الناحيتين الأكاديمية والاجتماعية، بالإضافة إلى جودة الفضاءات الحضرية والمساحات الخارجية المفتوحة داخل الحرم الجامعي. وصنفت الدراسات مجموعة من الاحتياجات، والتي تقوم على أساس الاحتياجات الأساسية التي وسعها ماسلو. يركز هذا البحث على جانب العلاقات الهيكلية للتكوين المكاني، وعلاقتها بجودة الفضاءات الخارجية للكلية. وقد حددت العديد من الدراسات الاحتياجات المطلوبة لتحقيق هذه الجودة التي يقوم عليها هذا المفهوم. ومن خلال الارتباط بين التكوين التركيبي للفضاءات الخارجية وأثره في تحقيق تلك الحاجات، تظهر ضرورة البحث في أهمية المؤشرات التحليلية لقواعد التحليل المكاني.

**الكلمات المفتاحية:** بناء الجملة المكانية، جودة الحياة الجامعية (QCL)، التحليلات المكانية، التكوين المكاني، خريطة العمق

### 1. Introduction:

Quality of university life is a concept that is essentially linked to the concept of quality of life that appeared first. According to the World Health Organization, it is a broad concept that is affected in complex ways by a person's physical health, psychological state, degree of independence, social relationships, and their

relationship to the prominent features of his environment, which is the ability to achieve human well-being, such as health, happiness, Freedom of choice, life satisfaction. These indicators include the provision of food, clothing, shelter, drinking water, legal assistance, educational facilities, health care, security, and income. Later, Sergey and others discussed the concept of the quality of college life as a concept that deals with positive and negative aspects, both related to academic matters and social aspects. This concept was adopted as the basis for the standard survey of the quality of college life that was conducted in many colleges and universities in the United States of America. Despite this, it was not The survey includes the quality of outdoor spaces. As for the study by Tawfiq and others, their study dealt with the quality of outdoor spaces, including the quality of university life and the needs of students in the open spaces of the university campus. The study adopted three main theories, all of which adopted Maslow's expanded pyramid of human needs. It was within two groups of first needs, the first of which is called “deficiency needs,” including basic needs such as physiological, safety, and social esteem needs. The second group is called “developmental needs” and includes advanced needs such as cognitive, aesthetic, self-actualization, and self-transcendence needs (Maslow 1954).

|                              | Carr’s Principles                                                                                                                                                   | Smith et. al Approach                                                                                                                                                                | Lang’s Function alism Theory                                                                |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>Theory base</b>           | Previous research and case studies                                                                                                                                  | Social and psychological theories; Jarvis, lang, lennard, lynch, maslow, etc.                                                                                                        | Maslow’s hierarchy of                                                                       |
| <b>Needs in urban spaces</b> | <ul style="list-style-type: none"> <li>● Comfort</li> <li>● Relaxation</li> <li>● passive engagement.</li> <li>● active engagement.</li> <li>● discovery</li> </ul> | <ul style="list-style-type: none"> <li>● Livability.</li> <li>● Character.</li> <li>● Connection.</li> <li>● Mobility.</li> <li>● personal freedom.</li> <li>● Diversity.</li> </ul> | Physiological, Safety, Affiliation, Esteem, Aesthetic , self-actualization, cognitive needs |

**a comparative table between the three mentioned needs theory in the built environment. resource: (Tawfik Mohamed, Mandour, and Baker 2023)**



According to the same study, 7 basic needs were identified and were as follows: Physiological Quality, Safety & Security Quality, Social Quality, Functional Quality, Aesthetic Quality, Aesthetic Quality, Cognitive Quality: Self-esteem, and self-actualization. Self-esteem & self-actualization quality.

**Aim of the study:** This study aims to investigate the effectiveness of Space Syntax Analysis of Open Space to improve the Quality of College Life (QCL) through spatial structure.

## **2. Methodology:**

- Literature Search On Needs Related To The Quality Of College Life (Qcl) In Open Spaces Of University Campus.
- Literature Search On The Relationship between Quality of College Life (QCL) needs And space syntax Analysis.

## **3 . Campus Morphology And Spatial Configuration Effect On Quality Of College Life (Qcl):**

### **3. 1. The effect of spatial configuration (campus morphology) on physiological quality: Visual Comfort AS A Quality indicator of Physiological quality**

according to Lang physiological Comfort includes biological (or physical), thermal, visual, and acoustic comfort. when Occupants' surrounding conditions are agreeable and comfortable for them to carry out their activities without hindrance (Smith, Nelischer, and Perkins 1997).

according to (Marty et al. 2003) is the state in which a clear and unobstructed reception of visual messages from the visual environment is possible without affecting the person's well-being or health (Houel, Lescop, and Joly 2021). (Tawfik Mohamed, Mandour, and Baker 2023) discussed the impact of good views on campus, and providing student spaces with pleasant views that effects largely with campus morphology (Carmona 2021).

### **3. 2 The effect of spatial configuration (campus morphology) on Functional Quality: accessibility**

Functional Quality Is how the design meets space function (Carmona 2021) according to (Carr 1992) Accessibility is an important factor affecting functional quality which can be conceptualized into three components: physical, visual, and symbolic accessibility. (Gehl 2020) Insert other factors such as smooth transitions between areas (Gehl 2020). all of the three components: physical, visual, and symbolic as a functional dimension in urban spaces is related to how spaces work (Carmona 2021) which is related to spatial configuration.



### 3. 3. The effect of spatial configuration (campus morphology) on Cognitive quality:

Evaluating the levels of quality of university life is largely related to achieving the cognitive or perceptual ability of university students within external university spaces (Tawfik Mohamed, Mandour, and Baker 2023). according to Maslow, The cognitive need is the expression of a person's natural need for natural learning, discovery, and creativity to obtain a better understanding of things (Maslow 1954).

Based on Kevin Lynch's theory, (Lang and Moleski 2016) identified five points on the mental map of the campus in an urban context he defines it as the ability to interpret the environment and perceive its components and properties: **Strong core** (student spaces or campus plazas), **Clear boundary: (campus gates and fences)**, An architectural unity (campus design style and identity through elevations, and architectural vocabularies), A name (campus name), The same type of activities (activities related to academic life), and the same building use type (academic buildings). According to (Tawfik Mohamed, Mandour, and Baker 2023) the ability to perceive campus morphology and create a student mental map. spatial cognition is an indicator of (QCL).

Therefore, it can be concluded that the physiological, functional, and cognitive quality, as basic needs of university students, are affected by the structural and morphological structure of outdoor spaces. We can determine the effect of spatial configuration on the quality of university life within three Dimension :

1. Physiological Quality.
2. Functional Quality.
3. Cognitive Quality.

### 4. criteria from space syntax effect on student needs in university's open spaces

Space syntax is a theory introduced by Hillier and Hanson that quantifies and studies the relationship between human behavior and the built environment (Hillier 2007). In space syntax, an "axial map" or a "segmentmap" is established based on an areal urban map or represents the the urban network configuration. (Sheng, Wan, and Yu 2021).

Space Syntax is an area of research that deals with investigating spatial configurations in an attempt to identify their logic and structure. Space Syntax is a valuable tool for characterizing and evaluating architectural space patterns at the building and urban levels. It aims to address several inquiries, such as: What is the best way to quantify the configuration features of spatial systems?



Furthermore, how do spatial cognition and configuration relate to one another? (Tarabieh et al. 2018).

We can identify the indices of Space syntax that affect (QCL) as the following:

#### 4.1 - indicators that effect on physiological quality: Visual Comfort:

The term "isovist" originates from Gibson's idea that people can perceive out-of-sight surfaces through motion or deduction (Davies, Mora, and Peebles 2006). M. L. Benedikt is credited with providing the most widely recognized definition of an isovist as well as introducing a series of analytical measures of isovist features. An isovist is "... the set of all points visible from a given vantage point in space and to those points," according to Benedikt (M. L. Benedikt 1979). to a setting. In a nutshell, an isovist is a visual record of everything visible from a certain point at a 360° angle. Average eye height is used to capture the visual record. Isovists depict space from the perspective of the individual as they experience, engage with, and navigate it (Yamu, Van Nes, and Garau 2021).

As we're navigating through unfamiliar territory, We NEED to be able to see a visual representation of the locations. For most people, a 180-degree all-around field of view is adequate for city driving. On the other hand, an individual needs to move quickly in every direction within every area. And instant access to a 360-degree view of any area, facing all directions. And with every step, because every step may cause the field of vision to change dramatically. Likewise, a specific location.

Benedikt (M. L. Benedikt 1979) and (M. Benedikt and Burnham 2013) introduced several metrics to evaluate isovist shapes, including area, perimeter, compactness, skewness, and variance. These metrics measure the extent to which the polygons are either self-contained or dispersed in space, all in relation to a specific point x, which represents the origin of the Isovist (Davies, Mora, and Peebles 2006).

- **Compactness** has been mathematically defined by a circle whose radius is equivalent to the isovist's mean radial length and gives an account of how much the isovist's shape resembles a circle.

- **Variance and skewness** describe the degree of dispersion of the perimeter relative to x and the asymmetry of such dispersion respectively.

- **Occlusivity** measures "the length of the nonvisible radial components separating the visible space from the space one cannot see from point x", and therefore gives an idea of the degree of 'spikiness' of the isovist.

Benedikt's original measurements were expanded upon by Dalton's work [5], where he introduced:

- **drift**: drift is a feature determined by the shape of the isovist, and it quantifies the vector connecting the origin of the isovist with its centroid.



Furthermore, recent studies by Wiener and Franz [6] introduced the measurement of :

- **jaggedness**, which is inversely correlated with the convexity of the isovist and is defined formally as the ratio of the square perimeter to the area of the isovist.

. Isovists\_for\_orientation

(Xiang, Papastefanou, And Ng 2021) Discuss Benedikt's Approach Includes Six Geometric Measures:

- **The isovist area**: determines the polygon area.
- **The isovist perimeter**: determines the total length of the boundary
- **Occlusivity** is the combined length of all obscured edges on building surfaces, representing unclear or undefined parts.
- **Compactness** describes the compact and simple degree of the visual area.
- **Jaggedness** describes the complexity of the polygon based on the number of vertices and the vertex density as follows.
- **The variance and skewness** of the radial distance are measured through the maximum/ minimum radial line, and the length of the longest/shortest single radial line is used to generate this isovist indicator.

#### 4.2 indicators that affect Accessibility, as a measure of functional quality:

Spatial syntax methods analyze motion networks to quantitatively measure “spatial accessibility.” This method uses the graph theoretical accessibility index to measure spatial segregation. The focus is on describing the spatial impedance factors that separate sites, regardless of the nature of the separating activity. It measures accessibility from a given location to all other locations within a given distance of the location. All targets were considered to be of equal value regardless of land use (Charalambous and Mavridou 2012).

Space syntax analysis suggests that it is important to consider the perceived accessibility of different locations and the selected paths for reaching them. According to this approach, the most accessible locations are not necessarily the ones closest in physical distance, but rather those closely connected in terms of directional changes (Hillier et al., 2007). From a behavioral standpoint, this suggests that the cognitive complexity of a route, as gauged by the number of directional changes, significantly influences pedestrians' path choices, often more so than physical distance. Therefore, pedestrians are expected to prefer routes with fewer directional changes, as opposed to the shortest routes (Charalambous and Mavridou 2012).

According to (Charalambous and Mavridou 2012), two main indicators were identified related to accessibility. Both of them are part of the broader theoretical and methodological realm of space syntax, which was pioneered at the Space Lab of University College London:



- **Spatial Integration Accessibility (SIA):**

- SIA focuses on the frequency of directional changes required for a journey within a city's transportation network from one location to another. The concept of proximity and the perception of accessibility within a city's street network are influenced by the experience of traversing an urban environment, encompassing more than simply the distance or time taken to reach a destination. In contrast to conventional accessibility metrics, which rely solely on distance or travel time, cognitive studies of accessibility also consider the "complexity" involved in pedestrian travel to a location. Spatial integration is highly significant as it assesses the intricacy of pathways within an urban area and takes into consideration the crucial subjective aspect of accessibility.

- **Accessibility and Angular Segment Analysis by Metric Distance (ASAMeD):**

In ASAMD, in conjunction with axial line connectivity and topological distance, the additional indicators utilized include the segmentation of axial lines by junctions (segment map), the angularity between axial lines, and the measurement of metric distance on axial line segments.

**Both (SIA) and (ASAMD) both determine two primary indicators:**

- Integration (closeness): how close each segment is to all others under different types of distance and at a different scale, this is known as "to-movement". Integration describes how easy it is to get to one segment from all other segments. In practical terms, this would mean that pedestrians would end up in such a space more often and with less effort. This spatial attribute can then define the type of land use that would fit best in this space.

- Choice (betweenness): how much movement is likely to pass through each segment on trips between all other segments, again using different types of distance and different radii. Choice describes how likely you are to pass through the segment on trips, and so its potential as a route, from all segments to all others. Again, this spatial attribute can define the type of land use that would fit best in this space, possibly certain land uses would require spaces with a high integration value (Charalambous and Mavridou 2012).

(Lopes and de Hollanda Cavalcante 2012) the study identified two indicators of accessibility:

- **Micro Access Index )IAM(:**

An index was defined, which is called "Micro Access Index" or "I am", and is formed by the Measurement path choice probability, relative to the number of options a given user or navigator might have at each decision-making point within the urban grid. The measurement takes into account only the

direction options within the system, not accounting for any external interference, but only for the grid configuration (Fig. 01)

A measurement called the "Micro Access Index" or "IAm" was developed to assess path choice probability or navigator selecting a specific route among the available options at decision points within the urban grid. This evaluation focuses on the directional selections within the system and does not take external factors into account, concentrating solely on the layout of the grid (See Figure 01).

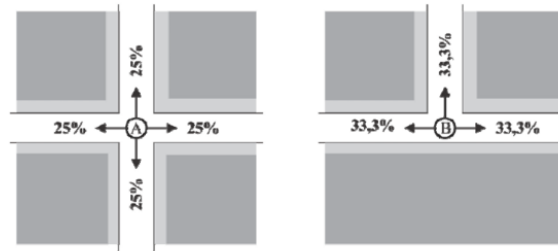


Figure 1.a - Four-way crossing

Figure 1.b - Three-way crossing

**figure 1** Tow examples of how to measure the raw direction probability, based on choice system, resource : (Lopes and de Hollanda Cavalcante 2012)

(Fig.01) depicts two instances resembling typical and commonly used urban grid layouts. One is a conventional four-way junction (Fig. 1.a) allowing a 25% possibility of selecting each direction, while the other is a three-way intersection (Fig. 1.b) presenting an equal 33,3% probability for each of the 3 routes. The calculation of choice probability is practically determined by dividing all available options (or 100%) by the number of feasible pathways (Lopes and de Hollanda Cavalcante 2012).

The "IAm" calculation (Equation 1) involves summing probability values (n) to access the choice probability measurements from directly connected crossings. The index aims to quantify how the spatial configuration of decision-making points influences access to a specific crossing within the grid.

$$IAm (A) = P1 + P2 + P3 + ... + Pn$$

where:  $IAm (A)$ : Micro Access Index of point "A";

$Pn$ : Probability of Accessing point "A", coming from points "n", directly adjacent to point "A"

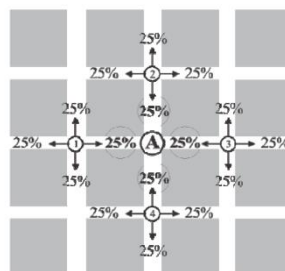


Figure 2

"IAm" (Micro Access Index) according to the equation (1). The "IAm" for crossing "A" would be  $1.0 = P1 + P2 + P3 + P4$ , or  $0.25 + 0.25 + 0.25 + 0.25$ ; the circled figures.



### ● Global Access Index (IAg):

The proposed values of "IA<sub>m</sub>" are adjusted by summing the values of other existing points in the urban grid's spatial cutout. These points belong to the approximation axis that shapes the studied crossing. Taking into account the influence of these points creates a new index, "IA<sub>g</sub>," which reflects the global accessibility of the urban grid. This is represented by a larger number of points, crossings, or nodes in the formation of accessibility. The "IA<sub>g</sub>" can be obtained from equation 2 and illustrated in Figure 3 (Lopes and de Hollanda Cavalcante 2012).

$$IA_g = \sum_{i=1}^n IA_{m_i} \quad (2)$$

where:      IAg:      Global Access Index;      i:      the first crossing to be account for;  
               IA<sub>m</sub>:      Micro Access Index;      n:      the last crossing to be accounted for.

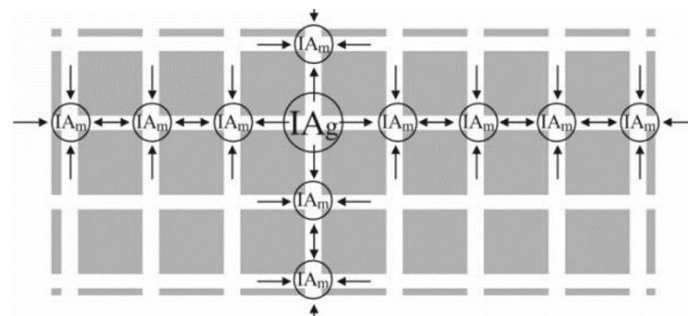


Figure 3  
 Global Access Index (IAg), formed by the sum of all IAm values, from the various crossings pertaining to the conforming axis that form the crossing under study, limited by the defined spatial cutout.

### 4.3 indicators that affect on Cognition quality:

Regarding The Spatial Configuration, Cognition Quality is Represented by the Ability To Perceive Campus Morphology And Create a Student Mental Map.

Gibson proposed in his Ecological Orientation that: "The visual Affordances for perceiving" - are organized within a formation called the Ambient Optic Array. The process of finding the way is an exploratory movement that selects scenes from the surrounding and tight visual arrays, and the learning place process therefore includes - Understanding the structure of the environment through the sequential arrangement of these scenes (Gibson 2014). Thus, it can be argued that spatial perception is closely linked to the ability to wayfinding skills.

If the part of our cognitive apparatus that allows us to predict others' whereabouts, act socially, and locate ourselves with respect to others in an intentional way is exosomatic and located in an environment constructed largely by others - we are



disabled if that apparatus is poorly structured. This is the effect of unintelligible space. By making it impossible for individuals to act intentionally, we remove autonomy as surely as if we tampered directly with the brain (Lopes and de Hollanda Cavalcante 2012).

According to (Dettlaff 2014) The fundamental equations and definitions presented below are crucial for understanding the method that was later improved and built upon. These include four syntactic calculations that can be performed.

#### • Connectivity:

Calculates the count of neighboring axes that are directly linked to a space. This indicates the immediate neighbor count for an axis. This measure is a local evaluation (with a parameter  $k = 0$ ). The connectivity for axis 1 in Figure 3 is 4 (Dettlaff 2014).

#### • Depth/degree of depth :

Topological depth refers to the minimal number of syntactic steps required to transition from one space to another. In a graph, the depth is measured using parameter  $k$ , where connectivity pertains to immediate neighbors and depth encompasses neighbors up to the  $k$ -th degree (Dettlaff 2014).

Connectivity and depth measures can be written as a sum:

$$\sum_{s=1}^m s \times Ns = \begin{cases} \text{connectivity iff } m = 1 \\ \text{local depth iff } m = k & 1 < k < l / \text{local depth (until } k = 3) \\ \text{global depth iff } m = l \end{cases} \quad (1)$$

where:

- $k$  – parameter,
- $s$  – operator ( $s$  is an integer),
- $l$  – the shortest distance,
- $Ns$  – the number of nodes with the shortest distance  $s$ .

Where  $1 < k < l$ , usually three steps are adopted for the calculation of *local depth*,

#### • Control value:

It Is The summation of the reciprocal values of the connectivity parameter of adjacent elements along the chosen axial line that quantifies the extent to which a specific area regulates entry to all proximate neighboring elements of the axis, incorporating various potential connections for these neighboring elements (Klarqvist and Jiang, 1993). This represents a dynamic localized evaluation (Dettlaff 2014).

#### • Local and global integration:



Integration, also known as availability, refers to how a space is connected to other spaces in its surroundings. It is a crucial factor for understanding the relationship between users and urban space, as well as a global measure. Higher integration leads to increased human presence, as it predicts the potential for gatherings within a space. Research suggests that well-integrated spaces attract more people, while lower integration may result in uncontrolled spaces and a heightened risk of criminal and antisocial behavior (Dettlaff 2014).

**Local integration:** is a metric that quantifies pedestrian movement in a certain area. It considers factors such as a 3-unit distance depth and a distance of 1250 meters from the starting point. Measurements for local integration should be taken within 5 syntactic steps.

### **Global integration :**

The assessment of the system includes consideration of integration, which captures the proximity of all system points from the origin (Hillier, Hanson, and Peponis 1984). The correlation established between integration levels and human occupancy in the area indicates that higher integration results in greater human presence within that space. The relationship between global and local space availability (integration) is evident in the clarity and readability of space. A strong correlation between these elements enhances users' understanding of their location within the urban context (Dettlaff 2014).

(Penn 2003) Discuss the spatial Cognition through the following indicator of integration. the correlation between spatial integration and movement (an area's 'predictability') is itself correlated to the degree of 'intelligibility' of the area (that is the correlation between local and global spatial measures) (Hillier et al, 1987). Thus as areas become less intelligible, they also appear to lose the relationship between spatial integration and movement (Hillier et al 1992) (Lopes and de Hollanda Cavalcante 2012).

- (Long and Baran 2006) conducted a two-phase research study in Changsha, China to investigate the link between spatial configuration and sketch maps. They aimed to determine whether an understandable environment leads to a legible one and to examine the impact of spatial configuration on urban legibility. They utilized space syntax techniques to gauge the syntactic characteristics of neighborhoods and employed cognitive mapping and interviews for assessment. Evaluating\_Way\_Finding .

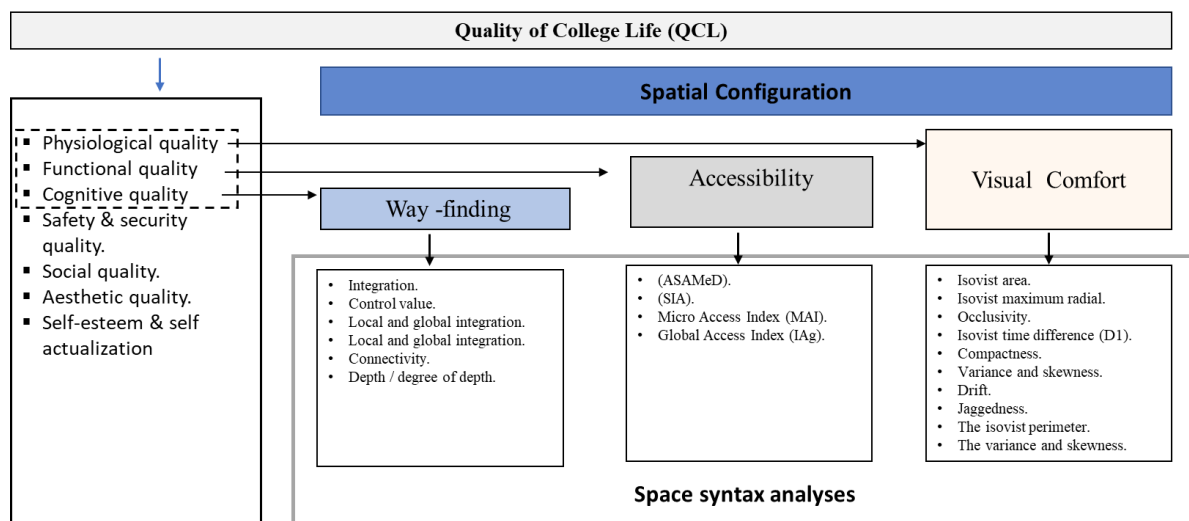
- (Turner 2007) research examined the link between Cognition and intelligibility of spatial configurations. His findings indicated a significant correlation between the intelligibility of spatial layouts and spatial cognition, with highly integrated routes being the most perceptible and legible.



## 5 . Conclusion:

QCL As A Concept Is Influenced By Several Dimensions In Terms Of Academic And Social Aspects, As Well As The Quality Of Urban Spaces And Outdoor Spaces On Campus. The Research Is Concerned With The Urban Aspect In Terms Of The Quality Of The Outdoor Spaces Of The Campus And The Identification Of The Necessary Needs To Achieve Such Quality. The Research aimed To Try To Identify The Indicators Of Spave Syntax Analysis That Affect The Quality Of College Life. The Study Summarized The Identification Of Indicators That Could Influence Indicators That Can Affect The Quality Of University Life (QCL), As Follows:

- The Effect Of Spatial Configuration on Visual Comfort As A Quality Indicator affects Physiological quality through the "isovist" analyses indicators: The isovist area, The isovist perimeter, Occlusivity, Jaggedness, variance and skewness, Compactness and drift.
- The effect of spatial configuration on accessibility As A Quality Indicators affects Functional quality through the indicators: Spatial Integration Accessibility (SIA), Accessibility and Angular Segment Analysis by Metric Distance (ASAMeD), Micro Access Index( IAm( and Global Access Index (IAg).
- The effect of spatial configuration (campus morphology) on Cognitive quality through the indicators : Connectivity: Depth/degree of depth, Control value, Local and global integration, integration, Intelligibility.



**Figure 4 - shows the correlation between the quality of university life vocabulary and the indicators of space syntax analysis**



|   |                                         | Quality of College Life (QCL)                       |                                                                                                       |                                                                              |                                                          |                                                                                                                           |                                                          |                                                                                             |                                      |                       |                                                                                                       |                                                                                                            |                                         |                                                      |                                                                                   |                                                                                                                      |                                                     |                                                                                             |                       |                                                |                                                                                             |                                                                                                            |
|---|-----------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------------------------|--------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------|-----------------------|------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
|   |                                         | Cognition quality<br>Way- finding process           |                                                                                                       |                                                                              |                                                          |                                                                                                                           |                                                          |                                                                                             | Functional quality<br>Accessibility  |                       |                                                                                                       |                                                                                                            | physiological quality<br>Visual Comfort |                                                      |                                                                                   |                                                                                                                      |                                                     |                                                                                             |                       |                                                |                                                                                             |                                                                                                            |
|   |                                         | I<br>N<br>T<br>E<br>G<br>R<br>A<br>T<br>I<br>O<br>N | V<br>i<br>s<br>u<br>a<br>l<br>I<br>N<br>T<br>E<br>L<br>L<br>I<br>G<br>I<br>B<br>I<br>L<br>I<br>T<br>Y | A<br>x<br>i<br>a<br>l<br>I<br>N<br>T<br>E<br>G<br>R<br>A<br>T<br>I<br>O<br>N | C<br>o<br>n<br>t<br>r<br>o<br>l<br>v<br>a<br>l<br>u<br>e | L<br>o<br>c<br>a<br>l<br>a<br>n<br>d<br>g<br>l<br>o<br>b<br>a<br>l<br>i<br>n<br>t<br>e<br>g<br>r<br>a<br>t<br>i<br>o<br>n | C<br>o<br>n<br>n<br>e<br>c<br>t<br>i<br>v<br>i<br>t<br>y | D<br>e<br>p<br>t<br>h<br>/<br>d<br>e<br>g<br>r<br>e<br>e<br>o<br>f<br>d<br>e<br>p<br>t<br>h | (<br>A<br>S<br>A<br>M<br>S<br>D<br>) | (<br>S<br>I<br>A<br>) | M<br>i<br>c<br>r<br>o<br>A<br>c<br>c<br>e<br>s<br>s<br>i<br>n<br>d<br>e<br>x<br>)<br>!<br>A<br>m<br>( | G<br>l<br>o<br>b<br>a<br>l<br>A<br>c<br>c<br>e<br>s<br>s<br>i<br>n<br>d<br>e<br>x<br>(<br>I<br>A<br>g<br>) | Iso<br>vis<br>t<br>are<br>a             | Iso<br>vis<br>t<br>ma<br>xi<br>mu<br>m<br>rad<br>ial | Q<br>u<br>a<br>l<br>i<br>t<br>y<br>i<br>n<br>d<br>e<br>x<br>(<br>I<br>A<br>g<br>) | I<br>s<br>o<br>v<br>i<br>s<br>t<br>t<br>i<br>m<br>e<br>d<br>i<br>f<br>f<br>e<br>r<br>e<br>n<br>c<br>e<br>(<br>D<br>1 | C<br>o<br>m<br>p<br>a<br>c<br>t<br>n<br>e<br>s<br>s | V<br>a<br>r<br>i<br>a<br>n<br>c<br>e<br>a<br>n<br>d<br>s<br>k<br>e<br>w<br>n<br>e<br>s<br>s | d<br>r<br>i<br>f<br>t | j<br>a<br>g<br>g<br>e<br>d<br>n<br>e<br>s<br>s | T<br>h<br>e<br>i<br>s<br>o<br>v<br>i<br>s<br>t<br>p<br>e<br>r<br>i<br>m<br>e<br>t<br>e<br>r | T<br>h<br>e<br>v<br>a<br>r<br>i<br>a<br>n<br>c<br>e<br>a<br>n<br>d<br>s<br>k<br>e<br>w<br>n<br>e<br>s<br>s |
| 1 | (Davies, Mora, and Peebles 2006         |                                                     |                                                                                                       |                                                                              |                                                          |                                                                                                                           |                                                          |                                                                                             |                                      |                       |                                                                                                       |                                                                                                            |                                         |                                                      |                                                                                   |                                                                                                                      |                                                     |                                                                                             |                       |                                                |                                                                                             |                                                                                                            |
| 2 | Xiang, Papastefanou, and Ng 2021        |                                                     |                                                                                                       |                                                                              |                                                          |                                                                                                                           |                                                          |                                                                                             |                                      |                       |                                                                                                       |                                                                                                            |                                         |                                                      |                                                                                   |                                                                                                                      |                                                     |                                                                                             |                       |                                                |                                                                                             |                                                                                                            |
| 3 | (Lopes and de Hollanda Cavalcante 2012) |                                                     |                                                                                                       |                                                                              |                                                          |                                                                                                                           |                                                          |                                                                                             |                                      |                       |                                                                                                       |                                                                                                            |                                         |                                                      |                                                                                   |                                                                                                                      |                                                     |                                                                                             |                       |                                                |                                                                                             |                                                                                                            |
| 4 | (Lopes and de Hollanda Cavalcante 2012  |                                                     |                                                                                                       |                                                                              |                                                          |                                                                                                                           |                                                          |                                                                                             |                                      |                       |                                                                                                       |                                                                                                            |                                         |                                                      |                                                                                   |                                                                                                                      |                                                     |                                                                                             |                       |                                                |                                                                                             |                                                                                                            |
| 5 | (Dettlaff 2014                          |                                                     |                                                                                                       |                                                                              |                                                          |                                                                                                                           |                                                          |                                                                                             |                                      |                       |                                                                                                       |                                                                                                            |                                         |                                                      |                                                                                   |                                                                                                                      |                                                     |                                                                                             |                       |                                                |                                                                                             |                                                                                                            |
| 6 | Penn 2003                               |                                                     |                                                                                                       |                                                                              |                                                          |                                                                                                                           |                                                          |                                                                                             |                                      |                       |                                                                                                       |                                                                                                            |                                         |                                                      |                                                                                   |                                                                                                                      |                                                     |                                                                                             |                       |                                                |                                                                                             |                                                                                                            |

TABLE 2 – indicators effected on Quality of College Life (QCL) according to literature review

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