WAYFINDING IN AN EDUCATIONAL ENVIRONMENT: A CASE STUDY IN ÇANKAYA UNIVERSITY

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ABSTRACT

WAYFINDING IN AN EDUCATIONAL ENVIRONMENT: A CASE STUDY IN ÇANKAYA UNIVERSITY

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The wayfinding system is a set of tools and design concepts that aim to increase the efficiency of navigation and destination finding within an environment. Therefore, designers and researchers need to pay special attention in order to provide the best possible experience within the built environment. The aim of this study is to evaluate the wayfinding strategy at Çankaya University, Ankara by measuring the individual's time to reach a destination and the number of times getting lost with respect to individual factors. The sample group consisted of forty-four participants who performed an experiment in the university campus. The experiment consisted of finding four destinations varying in complexity and the distance from the starting point. After the experiment the participants filled a questionnaire to evaluate the wayfinding system implemented in the university building. The results showed that the current signage system implemented in the university building is insufficient, as they are described as very small, not visible and not understandable. Several landmarks that were available helped many participants find their destinations. There were significant differences in perceived destination difficulty based on nationality (Arab and Turkish). The correlation analysis showed that perceived difficulty of finding three of the four destinations has a negative medium correlation with nationality, indicating that Turkish participants found the destinations more difficult to find. This study suggests that additional signage and landmarks should be integrated into the wayfinding system of the university building.

Keywords: Wayfinding, Educational Environment, Wayfinding System Evaluation, University Campus

ÖZ

EĞİTİM ORTAMLARINDA YÖN BULMA: ÇANKAYA ÜNİVERSİTESİ'NDE SAHA ÇALIŞMASI

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Yönlendirme sistemi, bir ortamda navigasyon ve hedef bulma verimliliğini artırmayı amaçlayan bir takım araçlar ve tasarım konseptleridir. Bu nedenle, tasarımcılar ve araştırmacılar, yapılı çevrede mümkün olan en iyi deneyimi sağlamak için özel dikkat göstermelidirler. Bu çalışmanın amacı, Çankaya Üniversitesi, Ankara'daki yön bulma stratejisinin, bireylerin bireysel faktörlerine göre hedeflerine ulaşma zamanını ve kayıp zamanlarını ölçerek değerlendirmektir. Örneklem grubu üniversite yerleşkesinde bulunan kırk dört katılımcıdan oluşmaktadır. Deney, zorlaşan ve başlangıç noktasından uzaklaşan dört varış noktasını bulmaktan oluşmaktadır. Deneyden sonra katılımcılara üniversite binasında uygulanan yön bulma sistemini değerlendirmek için bir anket uygulanmıştır. Sonuçlar, üniversite binasında uygulanan mevcut işaret sisteminin yetersiz, çok küçük ve anlaşılabilir olmadığını göstermiştir. Bulunan bir çok simge, çoğu katılımcıya hedeflerini bulmalarında yardımcı olmuştur. Milliyete (Araplar ve Türkler) göre algılanan hedef zorlukta önemli farklılıklar bulunmuştur. Korelasyon analizi, dört varış noktasından üçünün saptanması zorluğunun milliyet ile negatif bir orta düzeyde korelasyona sahip olduğunu ve Türk katılımcıların hedefleri daha zor bulduklarını göstermiştir. Bu çalışma, ek yönlendirme işaretlerin ve simgelerin üniversite binasının yön bulma sistemine entegre edilmesi gerektiğini önermektedir.

Anahtar kelimler: Yön Bulma, Eğitim Ortamı, Yön Bulma Sistem Değerlendirmesi, Üniversite Yerleşkesi

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1. INTRODUCTION

The concept of wayfinding emerged in order to provide directions or definitions to locations and structures; however, the modern form of wayfinding has developed since the sixteenth century, which associated the concept with processes (Passini, 1984). Therefore, architects and designers have to pay special attention to the wayfinding strategies and tools in order to provide an efficient navigation experience in built environments (Alves and Arezas, 2012). Furthermore, cognitive mapping is one of the important concepts in wayfinding, where the ability of the people to perform within the built environment in terms of navigation is measured (Tuncer, 2007). People are able to navigate through the built environment through spatial knowledge that allows them to navigate using their memory of specific recognizable items (Wiener, Buchner and Hölscher, 2009).

There are several factors that affect wayfinding within the built environment, including architectural, graphical and individual factors. The architectural factors mainly describe the impact of the building design on the ease of navigation, where size, area and complexity contribute into facilitating a better wayfinding. The way the different elements within the building are integrated plays a major role in the ability of the people to form a cognitive map and differentiate between the different zones. Architectural legibility is one of the dimensions that impacts wayfinding according to the availability of visual access to the outside.

The spatial dimension is also influential in determining the efficiency of the wayfinding strategy. The circulation system is planned and designed in buildings through five main components; landmarks, nodes, districts, paths and edges (Najafpour, Naghdbishi and Asadi Malekjahan, 2017). The way these elements are integrated and distributed determines the ability of the people to communicate with the built environment for navigation (Huang and Yu, 2013). Furthermore, the graphical factor has an impact on wayfinding based on the orientation and simplicity of the wayfinding tools, i.e. maps and signs (Symonds, 2017). The individual factor

is one of the most crucial assessment points in wayfinding as it mainly measures the perception differences between different people. Gender, age and culture can affect the way different people navigate in the built environment.

Educational environments are considered complex due to the variety of facilities that are provided on campuses, as well as the lack of familiarity by part of the users. Thus, mapping and sign systems are usually implemented in university and school campuses in order to increase the usability of the built environment and facilitate navigation of each person according to their specific destinations. Based on that, this research comes to add to the literature through studying the efficiency of the wayfinding strategy implemented in the building at Balgat campus of Çankaya University in Ankara and the impact of individual factors on it.

1.1 Aim of the Study

The aim of this research is to evaluate the wayfinding strategy at Çankaya University, Ankara (Balgat campus) by measuring the time to reach a destination and the number of times getting lost during wayfinding. Moreover, the efficiency of the wayfinding strategy is assessed in conjunction with individual factors in order to understand the impact of these elements on the ability of people in following the wayfinding tools. Based on the aim of the study, the following objectives are identified for the research:

1. Understand the concept of wayfinding and the different factors that affect its efficiency, in addition to different strategies that are used to assess its systems.
2. Perform a case study that measures the efficiency of wayfinding, as well as the impact of individual factors on the ability of people to find destinations within the built environment.
3. Compare the results of the case study with similar findings from the literature to highlight the similarities and differences.
4. Provide recommendations for wayfinding strategies for educational environments in order to increase efficiency and account for the individual differences.

1.2 Structure of the Thesis

As the main concepts of the research are introduced in the first chapter, the aim and objective of the research are also identified. The second chapter contains a literature review of the factors studied in this research. Therefore, wayfinding is identified, along with spatial cognition in wayfinding and the different elements that determine it. Moreover, the factors that affect wayfinding and navigation are explored through architectural cues, graphical cues and individual differences. Architectural cues are explained with respect to global and local cues. Maps and sign systems constitute the graphical cues. Individual differences are stated as gender, age and cultural differences and spatial familiarity. Wayfinding in educational buildings is also studied through the literature survey, which allows the researcher to form a clear idea about the distinguishing factors from other building types.

The third chapter lays the methodology of the research by starting with the research questions and hypotheses that are tested in the case study. The chapter provides information about the participants and the site, in which the experiment is performed, as well as the procedure that is followed for assessing wayfinding. The chapter provides the results of the case study and the statistical analysis that is performed to correlate the individual factors with the performance of the wayfinding strategy. The fourth chapter provides the conclusions of the study and the recommendations of the researcher for wayfinding enhancement.

2. WAYFINDING

2.1 Wayfinding

Wayfinding, which has emerged in the sixteenth century, is the ability to reach a destination in a familiar or unfamiliar environment (Arthur and Passini, 1992). Primarily, the wayfinding process was denoted with the term "wayfaring" that refers to the travelling process by feet to specific places (Arthur and Passini, 1992). Wayfinding with its specific meaning has developed during the years by architects, urban planners, graphic designers, design professionals and environmental psychologists in order to describe the navigation process in built environments. Wayfinding is a spatial problem-solving activity that consists of three specific but interrelated processes of decision-making, decision execution and information processing (Arthur and Passini, 1992). The term itself is developing through the development of human and environment based on experience, empirical results and the occupation of the complex environment by the user.

The first book that explained and discussed the wayfinding process was published in 1960 by the American planner and architect Kevin Lynch[1]. Lynch (1960) defined wayfinding as the "consistent use and organization of definite sensory cues from the external environment in order to reach a desired destination" (p.3). The wayfinding process was described from the urban perspectives by using different concepts such as cognitive mapping (or environmental imaging) and spatial orientation (Passini, 1984). The concepts that are included in the book points to the ability of the user to symbolize the physical environment conceptually. Naturally, the experiments of different times for the city deliver information for the navigation process. Moreover, Lynch (1960) clarified that these experiments depend on the components of the environment including landmarks, paths, nodes, edges and districts. These modules and conceptions configure the basics of the wayfinding design theories as they are used currently. In the early 1970s, a pair of environmental psychologists, Rogers Downs and David Stea donated to the discussion of Lynch

[1] Lynch, K. (1960). The image of the city. Massachusetts, US: The MIT Press.

where they stated that the necessary processes including environmental perception, decision-making and cognition must be considered a part of the successful spatial orientation (Passini, 1984). They discussed that other dimensions can be added to the wayfinding definition when understanding the relationships and movements in the complex environments. Consequently, in the 1980s, Romedi Passini, an architectural and environmental psychologist, pronounced the wayfinding process from the built environment perspective (Passini, 1984). Passini (1984) asserted that wayfinding necessitates complete involvement with the environment.

In addition to the information that have been stressed by Stea and Downs, and Lynch, Passini encouraged the use of empirical evidences including surveys and interviews in order to obtain feedback from the user (Arthur and Passini, 1992). Exchange of wayfinding information with the user helped to determine various issues that are faced by the user during navigation in specific environment such as illegible wayfinding signs and maps, misperception about clearing in emergency status and barriers to convenience. Barriers, which can be physical, sensorial, psychological or all of them, are faced by the user in specific environments and they can decrease the navigation ability in a complex environment. Wayfinding in a complex environment can be challenging when the individual has little or no spatial knowledge about the environment. Moreover, Passini (1984) discussed that designers can play a great role in the wayfinding design and guarantee the ease and ability of movement by the user. Insufficient and inadequate wayfinding systems can result in waste of time and productivity (Arthur and Passini, 1992). This operation is more than the consultation process with the graphic designer after finishing the spatial layout of the built environment and includes a team of architects, graphic designers, planners, and environmental psychologists.

2.2 Spatial Cognition in Wayfinding

Cognitive mapping is a process that is used in order to measure the ability of the people to accept and organize the data that comes from the built environment and the people's ability to perform within this environment (Tuncer, 2007). Thus, cognitive mapping can be defined as the psychological transformation series that enable the human to gather, form and preserve information about the built

environment and then display it in a map format (Tuncer, 2007). Arthur and Passini (1992) described cognitive mapping as “the mental structuring process leading to the creation of a cognitive map” (p.23). Typically, the backgrounds and the previous experiences of the individuals affect the process of perception in the built environment. Therefore, this process is considered a single process where it takes various figures from one to another. Thus, it can be said that cognitive mapping is a complicated property in wayfinding and it points to the variety and the psychical operations interference in its related relationships with wayfinding.

Cognitive map is a perception to the cross-section of the individual in particular moment (Tuncer, 2007). According to Arthur and Passini (1992) cognitive map is “an overall mental image or representation of the spaces and the layout of a setting” (p.25). In addition, it is a valuable tool in order to protect the information where it is used the brain of human to image numerous information associated with the environment and work on displaying the significant properties and features for this place whether that place is roads or complicated buildings and add the logical relationships between the components and the use of analytical tools which can get on statistical data for the features of this environment (Tuncer, 2007). There are three main knowledge types that form the spatial cognition in wayfinding; landmark knowledge, route knowledge and survey knowledge, which are reviewed in the following sections.

2.2.1 Landmark Knowledge

Landmark knowledge is the knowledge to differentiate the features of the point in space (Wiener et al., 2009). Landmarks are different characteristics within the environment that work as reference points to facilitate movement. For instance, in most types of environments, there are phenomenon or objects including mountain, surface, sound, building, plant, colour, animal, or light that stand out as a separate and continuing characteristic in a specific environment. Thus, they are used for navigation purposes by people in the environment in order to confirm where they are and in what direction they are heading. The landmark distinctness is identified as salience. The more distinct and continuing a landmark is in contrast to its environment, the greater its salience. Landmark knowledge is coded in semantic

long-term memory that can be familiar and remembered through future encounters with the salient landmarks (Wiener et al., 2009).

2.2.2 Route Knowledge

Route knowledge is knowledge about how to move from one point to another by the use of recall and sequence recognition of landmarks from procedural knowledge of body movements and decisions, semantic memory and route planning (Wiener et al., 2009). According to the people's perception and their procedural knowledge, they may use it in order to navigate from the starting point to the end point whether these landmarks are along the way or not. The landmarks that exist along the way may promote the perception that the person navigates in the intended route. Also, the landmarks may sign beneficial procedural knowledge about the navigation experience in specific route for example the key directional decision location or when to adjust your locomotion type or rate.

2.2.3 Survey Knowledge

Survey knowledge is knowledge about the abstract relationships of objects and points in space including orientation, distance, location and bearings (Wiener et al., 2009). Moreover, survey knowledge is coded in the long-term semantic memory, but it involves common cognitive processes (i.e., more than recall and recognition). Survey knowledge allows cognition in terms of temporal and spatial relationships that occur between professed phenomena and then it uses the knowledge of those relationships in order to notify understanding of one's present position and where other characteristics occur in relation to one's position bearings (Wiener et al., 2009).

2.3 Architectural Cues

Cues are defined as architectural components that form the wayfinding system or strategy that is implemented in the built environment, whether they are part of the wayfinding maps, signage or the architectural layout of the environment, which allows for the most efficient navigation. Designing wayfinding components have to have a clear objective in order to satisfy the needs of the built environment and its users. Hunter (2010) identified three main objectives that should be considered while designing wayfinding components, as well as the elements that are

associated with these components and objectives (see Table 2.1). The circulation around the premises should be clear, while the interior and exterior spaces should be grouped coherently. Furthermore, the legibility of the circulation system is achieved through implementing sufficient wayfinding tools that allows the users to move from the external to the internal spaces, and vice versa, as well as different levels of the structure. The last objective of the wayfinding system should be the ability of communicating with the users across the built environment by supplying graphics and location and orientation indicators (Hunter, 2010).

Table 2.1: Wayfinding objective and components (Hunter, 2010)

Wayfinding Objective	**Architectural Component**	**Element**
Creating a clearance and coherence between the different spaces around the built environment	Site shape and setting	- Entrances and exists - Landscape, pedestrian and motor roadways
	Form and features	- Volume of building - Separations between the different sections - Openings - Material used for different sections (textures and colours) - Decorative features and ornamentations
	Interior Spaces	- Definition of spatial units - Definition of separate zones
Forming a legible system for circulation	External and internal circulation	- Definition of paths, nodes, links and intersections - Entrances to the built environment and to the internal spaces - Connection between domestic and mass transportation
	Devices for level change	- Lifts, escalators and stairs
	Internal movement	- Moving belts, rails and people movers
Integrated communication	Information wayfinding systems	- Graphics - Signage - Orientation and location indicators

In any built environment, people use different methods in finding their destinations, including maps and directions provided verbally. However, the main wayfinding methods used are the cues provided in the environment. The architectural cues are primarily categorized as global and local, and the perception of these cues

differ from one person to another (Kanakri et al., 2016). The cues refer to the features that can assist the users in finding their directions including colour. Nonetheless, the wayfinding architectural cues are referred as landmarks, as the most common type of cues that are used by humans in wayfinding (Steck and Mallot, 2000).

2.3.1 Global Architectural Cues

The general form and spatial design of the built environments including the interior and the exterior parts define the global architectural cues that are provided in it. Global architectural cues are defined through architectural legibility and spatial configuration of the built environment. Although the individual perception in wayfinding depends on the local cues more than the global ones, increasing legibility and adopting a less complex configuration allows the individuals to navigate through it more efficiently. Visual connectivity, visibility, cluster forms and integration are additional elements that contribute to better wayfinding experience (Kubat, Özbıl, Özer and Ekinoğlu, 2012).

2.3.1.1 Architectural Legibility

The legibility of a structure is defined as the ability of the structure to generate a wayfinding system in a way that enables the users to extract the necessary information from the environment and understand the way to navigate through it and circulate around its different parts (Doğu and Erkip, 2000). Basically, the more the structure allows its users to understand the environment and the information provided by its design, the higher its architectural eligibility (Doğu and Erkip, 2000). Although the architectural legibility is not the only factor that affects wayfinding, as the spatial abilities of the users play a major role, people can get lost navigating in complex structures. Therefore, the architectural legibility seems to have a direct influence on the spatial abilities of the users during their wayfinding. Subsequently, architectural legibility is also defined as the easiness potential of the environment to understood and learned by humans (Li and Klippel, 2014).

Several elements contribute to enhancing or increasing architectural legibility of a structure, including the distribution of the entrances, the effectiveness of

horizontal and vertical circulation, ability to connect the interior of the building with exterior environment, and the availability of landmarks within the built environment (Demirbaş, 2001). Arthur and Passini (1992) indicated that clear articulation and coherent grouping of interior and exterior spaces, legible circulation systems design, and integrating communication systems can provide legibility within an environment.

2.3.1.2 Spatial Configuration

The global design of the environment has a direct influence on how users gain information for wayfinding. The spatial configuration of a structure is evaluated through three main factors; visibility, connectivity and the complexity of the layout. Studies show that there is a high influence of the structure complexity on disorientation, while the familiarity of the structure has a low influence (Li and Klippel, 2014). There are five main elements that form the spatial configuration of the built environment; paths, nodes, edges, districts and landmarks (see Table 2.2). Each of the elements has a different functionality that contributes to increasing the legibility of the environment and easing wayfinding for its users. Paths show the users the way they should follow to find their destinations, while edges show limits of the environment and districts form the reference point during navigation. Nodes and landmarks serve as secondary reference points, where the difference between them is the ability of the user to enter the environment (Najafpour et al., 2017).

Table 2.2: Elements of spatial configuration in the built environment (Najafpour et al., 2017).

Element	Function	Interior Example	Exterior Example
Paths	Navigation ways	Corridors	Streets and walkways
Edges	Environment limits	Edge walls and glass facades	Fences and rivers
Districts	Main reference points	Departments	Neighbourhood
Nodes	Secondary reference point which can be entered	Reception areas, intersections, conference and theatre rooms	Public buildings, town squares
Landmarks	Secondary reference point which cannot be entered	Wall paintings, statues,	Statues

2.3.2 Local Architectural Cues

There are two main properties that increase the helpfulness of cues in wayfinding within the local environment; type and location. Studies in the literature show that door colours and structural elements are among the most helpful cues that are used by participants to find their destinations (Davis and Weisbeck, 2016). The colour of the cues has also been found effective in increasing the memory of subjects of the environment and the set destinations, while the complexity of colour and form plays a major role in their ability to recognize their way in the environment. Furthemore, the location of the cues is found important in wayfinding. Placing cues at nodes, intersections and decision points is concluded as the most efficient locations in order to enable subjects to create a memory of the environment and the routes around it (Davis and Weisbeck, 2016).

The decision of the local architectural cues to be used in an environment is suggested to be based on the preference of the users in order to increase the accuracy of the individual behaviour. In a study performed with fifty-six students, the subjects indicated that following signage, asking other people and asking staff are the most preferred ways in finding exits in unfamiliar environments, respectively (Liu, Sun, Wang and Malkawi, 2013). The research emphasized that signage systems are the first local architectural cues that are used in finding destinations within the

environments, as well as finding entrances and exits (Liu et al., 2013). In a multi-level structure research, the architectural analysis showed that several items can serve as landmarks including vending machines and posters (see Figure 2.1; Vogels, 2012).

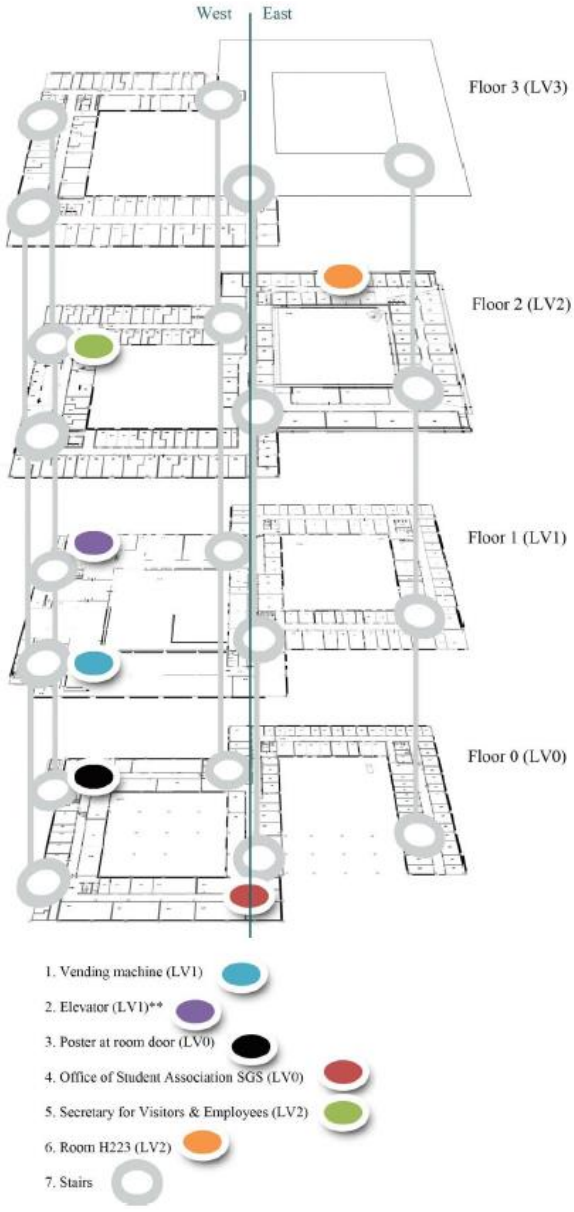

Figure 2.1: Location of landmarks in a case study in a university building (Vogels, 2012)

2.4 Graphical Cues

Graphical cues provided in an environment are one of the most important environmental variables that aid wayfinding, besides visibility, architectural differentiation and spatial configuration. The study of graphical cues is not only limited to their availability, but also to techniques that can make them more efficient and helpful, empowering the cognitive and spatial abilities of the users (Brösamle, Hölscher and Vrachliotis, 2007). Graphical cues are considered second after spatial configuration of the structure and physical landmarks that increase architectural legibility (Brösamle et al., 2007). As shown in Figure 2.2, wayfinding issues mainly emerge from the physical properties of the building; however, graphical cues that are provided are in the second line before users are pushed to use social tools, such as asking other users or staff members (Maina and Umar, 2015).

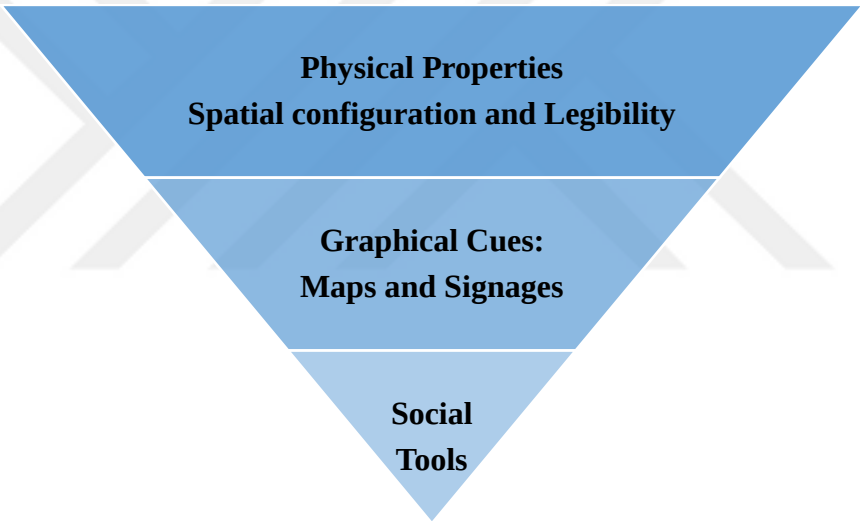

Figure 2.2: Wayfinding levels (Maina and Umar, 2015, p. 1231)

There are two main graphical cues that are used to increase wayfinding efficiency, especially in complex buildings; maps and signage. Maps are considered orientational graphic cues as they provide an illustration of the location of the individual and it facilitates the visualization of the route to be followed. Signage provides directions from a start point to the destination and directions along the route (Richter and Klippel, 2002). Both types of graphical cues allow unfamiliar users to navigate buildings, which their properties and best design practices are reviewed in the following sections.

2.4.1 Maps

Pollet and Haskell (1979) mentioned that maps are powerful in enabling users to form orientation within the environment; however, it is important to understand the time and the way maps are used in the navigation process. Mainly maps are utilized for three purposes as guides to exploration, as substitutes for exploration and as the basis for directions (Hunt and Waller, 1999).

According to Arthur and Passini (1992), the usage of maps is easy with the following recommendations:

- Maps should be placed at decision points to reduce confusion. In addition, maps constitute great importance for buildings with more than one floor.
- Maps should be placed on the ground floor of the building and especially in buildings that contain multiple floors.
- Maps must contain clear information that point to specific information such as restaurants, telephones, emergency shelters, public restrooms, strollers, first aid stations and information kiosks.
- The graphic of maps should be understandable and large enough to promote the information.
- Color maps should not produce glare on the surface and the information must be highlighted to be readable for people with impaired vision.

Another type of map is the one that shows the users their current location, i.e. “You Are Here” maps, as they provide a strong sense of orientation with the surrounding environment. The “You Are Here” maps are usually located at entrances, where decisions about destinations are made (Marquez, Oman and Liu, 2004; Muhlhausen, 2006). Moreover, cognitive map development is one of the important topics in wayfinding, as they target building maps and provide information on them in a way that efficiently communicates with the environment users. Cognitive maps, including the “You Are Here” maps, aim to incorporate landmarks in the mapping process and ensure the alignment of the map with the environment (McKenzie and Klippel, 2016).

Furthermore, the efficiency of the "You Are Here" and cognitive maps can be decreased through marking routes towards certain destinations. A study showed that marking routes in maps increases the time needed to reach destination and increases confusion (Lukas et al., 2014). Another study measured the wayfinding performance between maps and direction, where it showed that participants who followed maps recorded less direction errors. Nonetheless, the study compared two methods based on time, stops, getting lost and need for instructions. Participants who used maps needed more time to reach their destinations, stopped more to recognize surroundings and confirm their direction, while they got lost less than participants who used directions (Meilinger and Knauff, 2008).

2.4.2 Sign System

McLean (1993) provided several criteria that should be considered during the design of signage. The first criterion is not to include more than fifty characters in a single horizontal line as information becomes confusing and disturbing to the eye. Several information shall be communicated through the signage system that are destination information, current position and orientation. Also, graphics, textures and colour can be used in order to provide a unique perception of the type of destination. Furthermore, there are several types of signage that are used in the built environments. There is signage that are used to identify entrances, buildings or local destination that are called identification signs. The main location of this type is at the destination. Directional signs are used to provide directions and orientations along the route to the destination. Descriptive signs are used to identify floors, lift numbers, staircase numbers and room numbers. Other types are also used to identify hazardous and safety objects (Arthur and Passini, 1992; Pollet and Haskell, 1979).

Other than the criteria that shall be considered in designing signage, the location of the signage is an important issue to be taken into consideration while designing the wayfinding strategy (Greenroyd, Hayward, Price, Demian and Sharma, 2017). Moreover, during emergency state, individuals depend on signage more during their wayfinding. A study conducted in a virtual environment provided with directional and emergency signage, the authors simulated two situations; everyday and emergency. Results showed that participants used signage in their navigation

during the emergency state more than the everyday state. The same applies to individuals who are in rush in finding their destinations, which proves that an effective signage system is the ultimate and essential method in wayfinding (Vilar, Rebelo, Noriega, Duarte and Mayborn, 2014).

Calori and Vanden-Eynden (2015) presented a signage system design model that is based on three main components; information, graphics and hardware, which was named as the signage pyramid model (see Figure 2.3). The information component specifies the information that shall be displayed on the sign, the wording of the sign and the location of the signage around the environment. The graphics component creates the visual identity of the signage type to distinguish it from the other types or to distinguish zones from each other. Moreover, the graphics of the signage may include symbols, arrows and colour depending on the design. The hardware of the signage is its shape and size, which depends on the distance that it should be read from. Additionally, the hardware system indicates the mounting system of the signage and the way it is connected to other elements in the environment (Calori and Vanden-Eynden, 2015).

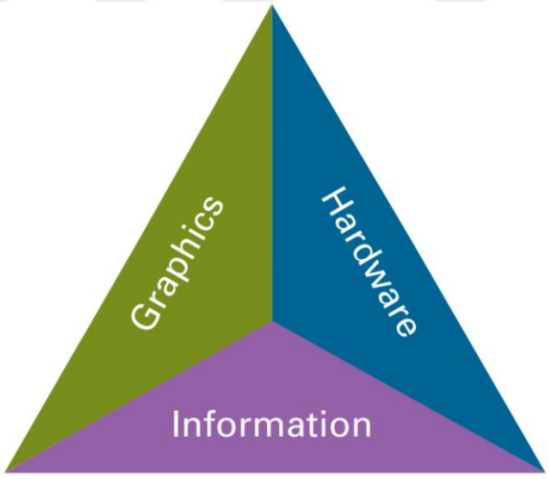

Figure 2.3: Signage pyramid method components (Calori and Vanden-Eynden, 2015, p. 81)

2.5 Individual Differences in Wayfinding

The literature shows three main factors that differentiate individuals in wayfinding; cognitive ability, perception and capacity for information processing (Li and Klippel, 2014). In a study that investigated the user behaviour in an educational

setting, sixteen participants were interviewed showing that people act differently in navigating around a space (Mandel, 2016). The human cognitive ability is an essential part in determining the efficiency of the wayfinding strategy as part of the wayfinding model that also includes wayfinding performance and the environmental variables within the space (Lu and Bozovic-Stamenovic, 2009). A study performed on thirty-five students used five main criteria to assess wayfinding in structures; time to reach destinations, confusion points, looking for signage, individual stress level and destination difficulty level. Other than the time and confusion, which were recorded by the authors, the rest of the indicators were assessed on a 10-point Likert scale from nothing to high (Kanakri et al., 2016). Such methodologies and results show that there are individual differences in wayfinding that are based on gender, age and cultural differences (Li and Klippel, 2014).

2.5.1 Gender Differences

In comparing males and females according to their preferences of wayfinding strategies, a study showed that males generally prefer using a global reference point, while females preferred using route information. Furthermore, women experience more anxiety during wayfinding, as well as feeling less safe during the process (Lawton and Kallai, 2002). Another study showed than men have better ability in distinguishing local and global landmarks, more than women, similar to the case of landmarks with trial blocks. The results also showed that women took a longer travel time to the same destinations than men (Lin et al., 2012).

A study performed in a shopping mall with 156 Canadian users, where the results showed that men scored a higher average for wayfinding (20.2 s) than women (16.9 s). However, the study showed that 33% of women more familiar with the directions in the shopping mall than men (Chebat, Chebat and Therrien, 2008). Another study investigated the gender differences in using mapping for wayfinding. The results showed that women took a longer time to learn the way to use the two types of maps (2D and 3D), with a higher timing for 3D maps. The same applied to response time, whereas mean had a higher accuracy during the experiment (Liao and Dong, 2017).

2.5.2 Age Differences

When it comes to age, the main criterion that determines the performance of an individual are response time and ability to establish landmarks through memory. Therefore, it is noticed that older age groups have less ability than younger age groups in wayfinding. A study recommended that signs used in a built environment should be designed for different age groups. Moreover, the study provided a few guidelines to achieve this goal through distinctiveness between the different types of signs and signs for certain destinations, consistency in graphic usage, simplifying the design of the signs, isolation of different zones in order to avoid confusions. In addition, signage at the intersections and along the route was provided (Mishler and Neider, 2017).

2.5.3 Cultural Differences

In order to investigate the cultural impact on wayfinding, a Chinese research utilized three hospital settings, where thirty-one participants added a new element to the wayfinding model, which was the relational pattern of a space. The authors confirmed that the addition of the new element was specifically related to the Chinese culture and showed that assessing wayfinding strategies based on cultural differences has the potential to yield important results (Lu and Bozovic-Stamenovic, 2009).

Studies also show that the way directions are described is different among cultures. While some of the cultures use the directional terms, such as left, right, and straight, other cultures use landmarks as a way of describing routes (Bangel, 2009). The findings of the latter research are proven through the comparison between the American and Dutch cultures, where the American participants were specific in providing street names, while the Dutch used mainly directional instructions (Hund, Schmettow and Noordzij, 2012). In response to a signage system that is provided in an airport, the American and the Chinese cultures were evaluated for cultural differences in wayfinding. The results showed that signage that contained symbols led to a faster performance by the Chinese participants (Leib, Dillman, Petrin and Young, 2012). While another research confirmed that different cultures design their wayfinding strategies using different approaches, methods and considerations (Kong,

2016) that indicate the impact of the cultural element on the individual factor. Moreover, a study showed that Americans, experience more anxiety during wayfinding than Hungarians (Lawton and Kallai, 2002).

2.5.4 Spatial Familiarity

The familiarity of the users with the environment plays a major role in their wayfinding technique and ability, which is also known as spatial knowledge. Moreover, the individual sense of direction and orientation allows the individuals to navigate smoothly in more familiar environment (Li and Klippel, 2014). Demirbaş (2001) mentioned four factors that influence the spatial familiarity of individuals in the built environment, which are experience, spatial ability and meaning and expectancy, and environmental complexity. The first factor, experience, is evident through research to impact the spatial familiarity of individuals in a conscious and unconscious manner.

The need for unfamiliar users to gather new information about the environment requires time for processing the information and responding to it. Moreover, the capacity of individuals to perceive the built environment differs from a person to person. Also, the meaning of different cues and the expected cues to be found influence the spatial familiarity of the individuals (Demirbas, 2001). Another study indicated that different individual factors consist of individual search strategy and motivation, besides experience and spatial ability (Chen, 2012). Chebat, Chebat and Therrien (2005) stated that people who were familiar with the environment used more information stored in their long-term memories, asked less help for wayfinding and used fewer maps and people who were unfamiliar used external sources more, such as maps, signs, and other people.

2.6 Wayfinding in the Built Environment

Studying wayfinding is essential for designers to ensure that spatial designs and wayfinding systems achieve the most efficient outcome and maximize the spatial abilities of the users. Factors, including positioning, placement and size of cues are vital in urgency states and rush hours to minimize confusion and disorientation. Wayfinding in the built environment is defined through a four-step process

orientation, route selection, route control and recognizing the destination (Farr, Kleinschmidt, Yarlagadda and Mengersen, 2012). The orientation step is the identification of the current position with respect to the destination. Thereafter, the individual choses the route that will be used to reach the destination. While following the chosen route, the individual needs a frequent confirmation that the correct route is being followed. Finally, the individual needs to recognize that the destination has been reached. Therefore, a successful wayfinding system should take into consideration these four steps and provide the required tools that would take the user from the start point to the destination with the fastest time and least confusion (Farr et al., 2012). The following sections review the literature based on the location of the wayfinding systems; interior and exterior built environment.

2.6.1 Interior Wayfinding

Wayfinding system implemented in indoor environments mainly depends on the complexity of the building. Therefore, the building type and functionality play a major role in selecting the wayfinding strategy and system. For instance, hospitals are known as complex structures due to the high number of departments they contain, while a museum can be divided according to a few sections. Generally, buildings with several floors, elevating points and non-congruent floors are considered more complex and their wayfinding systems need to take this into consideration. It is recommended that a wayfinding system based on landmarks is the best way to enhance navigation within complex structures (Eyedog Wayfinding, 2017).

Gangaputra (2017) defined interior landmarks as distinguishing points that are visible, dominant and provides spatial orientation information within the structure. Moreover, it can be a point that enable users to continue their navigation, an external point visible from the inside and can be used as a reference or located at a decision point. There are four main characteristics that are found in an interior landmark; uniqueness, contrast, spatial prominence and cognition (Gangaputra, 2017). The interior landmark should be different from its surroundings with an irregular shape and contrasts from its background in order to stand out. Moreover, the location of the landmark should indicate the importance of the area that it is placed in and preferred to have a serving functionality that can be remembered.

Contrary to the exterior landmarks, interior landmarks are often smaller, limited in number due to the limited environment, do not have obstructions and are less distinctive. Therefore, objects such as fire extinguishers, trash boxes, paintings, staircases, vending machines and elevators can all be used as landmarks when navigating in the built environment (Gangaputra, 2017).

Several signage systems can be used for the interior environment. A study on an interior virtual environment experimented the ability of human subjects to navigate and reach destinations (Vilar, Rebelo and Noriega, 2012). Three systems were used and defined as horizontal, vertical and neutral (see Figure 2.4). The horizontal system used colour coded signage and colour coded ground lines to provide directions to the destinations. The vertical system provided directional signs with arrow graphics and the neutral system did not provide any signage. With eighteen participants for each system, the three systems were compared based on distance travelled, time, number of pauses and travelling speed (Vilar et al., 2012).

Figure 2.4: Horizontal, vertical and neutral signage systems (from left to right) (Vilar et al., 2012, p. 6)

Table 2.3 shows the averages of each condition, where the horizontal condition recorded the shortest average time to reach destination, distance and number of pauses and the highest average speed, whereas the neutral condition recorded the worst performance averages.

Table 2.3: Comparison of average performance in horizontal, vertical and neutral signage conditions in indoor environments (Vilar et al., 2012, p. 9)

Signage conditions	Average Performance			
	Distance (m)	Time (s)	Pauses (no.)	Speed (m/s)
Neutral	313.8	186.6	6.4	1.8
Horizontal	125.2	69.3	3.1	2.0
Vertical	157.0	102.0	5.4	1.7

2.6.2 Exterior Wayfinding

Wayfinding in the exterior environments is more complex due to the variety of spatial configuration that is available and the variability in ergonomics. Therefore, the use of wayfinding systems is essential to locate destinations and ensure minimized distances and time. The layout of urban environments is expressed through the term urban morphology, which defines the overall shape of the city based on buildings' structure and roadways' formation (Alves and Arezas, 2012). Moreover, exterior environments include natural environments with less urbanised surroundings. In a study that experimented navigation and wayfinding in natural environments, fifteen participants were asked to go from a start point to a destination memorizing their route and communicating them. Thereafter, the participants were asked to describe the routes to other subjects. More than 80% of the participants used landmarks in their communications and descriptions rather than using orientations, while more than 55% used points for navigation descriptions rather than using areas or lines (Brosset, Claramunt and Saux, 2008).

2.7 Wayfinding in Educational Environments

In the literature, a study that aimed to develop a wayfinding tool for a university campus in the United States recognized the main goal as to make the campus environment more accessible and navigable for all the users, who should be able to find the different destinations and parts of the environment including departments, facilities and resources. Moreover, understanding the type of users that visit the educational environment is essential in order to design an effective

wayfinding system. Therefore, two user types were recognized by the aforementioned; new users, who can be new students or visitors requiring general information of the configuration of the environment, and users who are familiar with environment requiring specific details and information about certain destinations and sections of the environment (Roth, et al., 2009).

In school environments designed for children, colour was found as an assisting factor in wayfinding in such educational environments. A Turkish study using an experimental methodology tested the effect of colour in enabling children to enhance their route learning, finding destinations in an accurate and quick manner, and recognizing landmarks as they followed routes. The study tested differences in wayfinding using colour, based on gender differences and destination difficulty. A total of one hundred children participated in the study using a high school building that they were unfamiliar with. The children were distributed into three even groups to find six destinations (Helvacıoğlu, 2007).

The first group was put into an environment with neutral colour landmarks, i.e. grey, the other two groups were provided with landmarks with different colour sets. The results of the study showed that more than 70% of the children in the second and third groups who were provided with coloured landmarks found their destination accurately, while more than 70% of the children in the first group could not find the accurate position of the endpoints. Furthermore, the first group using the grey colour showed higher hesitation during the destination finding process, than the other two groups who showed more certainty. The colour enabled children in the second and third group to find their destinations in less than 60 seconds, while 43% of the first group spent up to 90 seconds and 40% spent up to 120 seconds in finding their destinations. As no colourful landmarks were provided for the first group, it was observed that children started using other landmarks in the building to find their destinations including fire cabinets, signages, drawing boards and radiators (Helvacıoğlu, 2007).

In evaluating wayfinding systems in educational environments, a recent study showed that there are five main criteria that can be assessed; time to reach

destinations, confusion/ lost points, points where signage is needed, stress level of the user and the perceived difficulty in finding a certain destination or part of the environment (Kanakri et al., 2016). The design of the study mainly depended on setting a start and end point for the participants, where their timing was recorded on a stopwatch, as well as for the times they stopped because of confusion or need for signage. Following the experiment, the participants were asked to indicate the level of stress and difficulty in finding the destination using a questionnaire based on a 10-point Likert scale varying from nothing to high. Thirty-five participants, who were the subjects of the study, were asked to find two destinations varying in their distance and complexity. The results showed less stress and difficulty levels for less complex destinations (Kanakri et al., 2016).

As this study aims to evaluate the wayfinding system implemented in an educational environment, a similar methodology to Kanakri and colleagues (2016) is utilized in order to perform the assessment. Nonetheless, the destinations that are chosen for this study have distinguished variations in distances and complexity. The destinations are distributed on different levels and with different distances. Moreover, the questionnaire used to evaluate the environment involves an assessment of different aspects of the spatial configuration, including entrances, connectivity with the outside environment and the availability of sufficient wayfinding tools.

3. CASE STUDY

3.1 Research Questions and Hypotheses

The aim of the research is to assess the wayfinding strategy in the building at Balgat campus of Çankaya University, Ankara based on time to reach destinations and number of times getting lost by the participants and correlate the results to the individual differences between the participants based on cultural differences. Therefore, the questions of the research are as the following:

Q1: How efficient is the wayfinding strategy in enabling the users to reach their destinations in the shortest time possible and without getting lost?

Q2: Is there a correlation between cultural difference and the ability to use the wayfinding tools available in the building at the Balgat campus of Çankaya University?

Based on the above, the hypotheses of the research that are tested through the case study are as the following:

H1: The current wayfinding system implemented in the building at Balgat campus of Çankaya University is not efficient in terms of time to reach destinations and number of times getting lost. The participants cannot reach the destinations within the optimal times.

H2: There is a significant difference between the Arab and Turkish participants in wayfinding based on times getting lost and time to reach destination or based on destination finding difficulty perception.

3.2 Participants

The sample group consisted of forty-four participants who were chosen randomly using stratified sampling from the population of university students in Ankara. There were 24 Arab participants (54.55%) and 20 Turkish participants (45.45%) whose ages range was from 17 to 54 years old. There were 35 males (79.5%) and 9 females (20.5%). Table 3.1 shows the demographic information of the participants.

Table 3.1: Demographics of the participants

Demographic Data	Category	Arab Participants	Turkish Participants	Percent (%)
Gender	Male	17	18	79.5
	Female	7	2	20.5
Age	Below 18	0	1	2.3
	18 to 25	4	15	43.2
	26 to 33	3	3	13.6
	34 to 41	12	0	27.3
	42 to 49	3	0	6.8
	50 and above	2	1	6.8
Total Participants		24	20	100.0

3.3 Description of the Site

The site of the case study is the building at the Balgat campus of Çankaya University located in Ankara, Turkey. The building in the campus consists of two blocks; A and B blocks with four floors. The ground floor plan is provided in Appendix A. The access to the building is provided through the ground floor by four main entrances and six secondary entrances. The entrance to Block A provides a direct access to the main corridor extending through Block B. The main corridor leads to four corridors in Block A and two corridors in Block B. There are different departments and facilities that are distributed along the main corridor. Block A contains the Graduate Schools, Faculty of Law and the library, whereas Block B contains the Faculty of Architecture and sports complex. Between the two blocks the other facilities are provided that are Student Affairs Office, food court and the conference hall.

The ground floor of Block B contains lecture halls, a sports complex, restrooms, management offices and forty-six rooms, while the ground floor of Block A consists of management offices, a Graduate School, restrooms and the library. Access to the upper floors is provided by six staircases; three in Block A and three in Block B. The majority of the entrances are distributed along the main corridor of the building giving a shorter access according to the desired facility.

The wayfinding tools that are provided in the building are signage in Turkish language only, while no maps or information desks are provided. The wayfinding system implemented in the building is only by signage that is limited to identification signs. No directional signs are found, which is expected to increase the difficulty in finding destinations within the building. Some landmarks can be found along the corridors and the department entrances. For instance, a vertical banner with the picture of Mustafa Kemal Atatürk and a three-dimensional status of his face on the wall can be clearly seen next to the entrance of the Student Affairs office (Figure 3.1). Moreover, the main corridor contains spatial elements including a fire extinguisher, plants and a showcase (see Figure 3.2).

Figure 3.1: Interior landmarks at the entrance of the Student Affairs Office including a banner and a statue of Mustafa Kemal Atatürk

Figure 3.2: Spatial elements along the main corridor of the university building

3.4 Procedure

The study is conducted in two phases. In the first phase, the participants are stationed at the entrance of Block B at the starting point of the route and introduced to the procedure (see Figure 3.3). The participant is asked to find the first destination (Destination A) by using the building signage. The researcher carries a map for recording the travelled path and starts the stopwatch as the participant starts to find the destination. The optimal route is marked on the map, the researcher follows the participant in a distance. The researcher records any diversion taken by the participant from the optimal route and records the total number of diversions at the end of the journey (times getting lost) on the recording map.

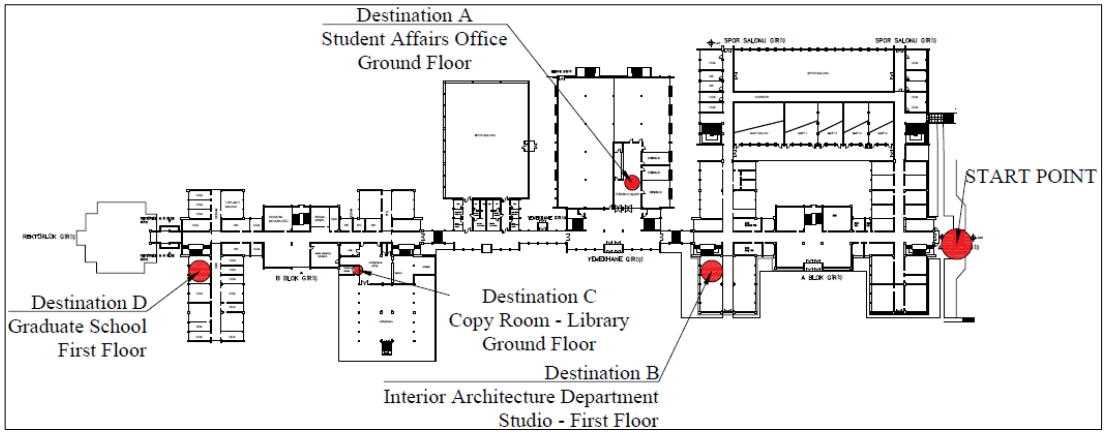

Figure 3.3: Map showing the starting point and the destinations used in the experiment

When the participant reaches the destination, the researcher stops the stopwatch and records the time it took the participant to reach it. The procedure is repeated for the other three destinations (Destinations B, C and D) starting from the same point. The number of times getting lost and the time to reach destination are recorded for each destination on the map. The destinations are selected to include different difficulty levels in finding them. Destinations A and B are close to the start point, while destinations C and D are located towards the end of the main corridor. Destinations A and C are located on the ground floor and used by the majority of the students, while destinations B and D are located on elevated floors and used mainly by students who attend classes in the specific schools. Destination C is considered the most difficult as it is a secondary destination inside the library.

In the second phase, a questionnaire is conducted to the participants in order to evaluate their experience and the wayfinding strategy of the building. The questionnaire (see Appendix B) is divided into two main parts as demographics and familiarity. The demographic part of the questionnaire aimed to collect information about the participants in order to study the individual differences based on their familiarity and performance in the experiment. The familiarity part of the questionnaire aimed to understand the usage behaviour of the participants in the case study site, as well as provide their evaluation on the wayfinding strategy. The participants indicated if they were familiar with the campus and how often they visited it. Moreover, the participants specified the purpose of their visits to the

campus and the entrance that they usually used to enter the building. The participants evaluated the wayfinding in the building by indicating if they got lost within the building and the possible reasons for it. Furthermore, the participants evaluated the signs that were provided in the building and their efficiency. Based on the experiment that they performed, the participants assessed the difficulty in reaching the four destinations on a 5-point Likert scale from “very easy” to “very difficult”.

3.5 Results and Discussion

The participants in the research were chosen randomly among the universities in Ankara, Turkey. The majority of the participants were of the age category between 18 and 25 years old (43.18%), followed by 34 to 41 years (27.27%) and 26 to 33 years (13.64%) (Figure 3.4).

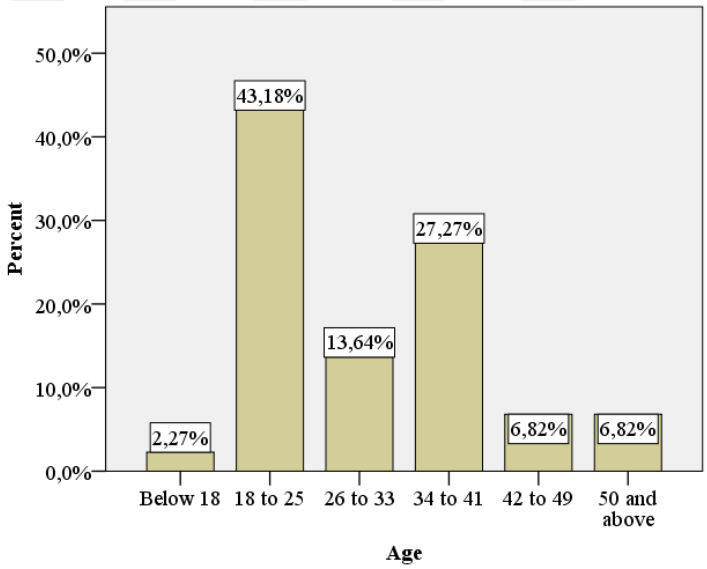

Figure 3.4: Age category of the participants

The participants indicated their educational levels, where 38.64% held a Bachelor’s degree, 29.55% held a master’s degree, 15.91% held a PhD degree, and 15.91% finished high school, as shown in Figure 3.5.

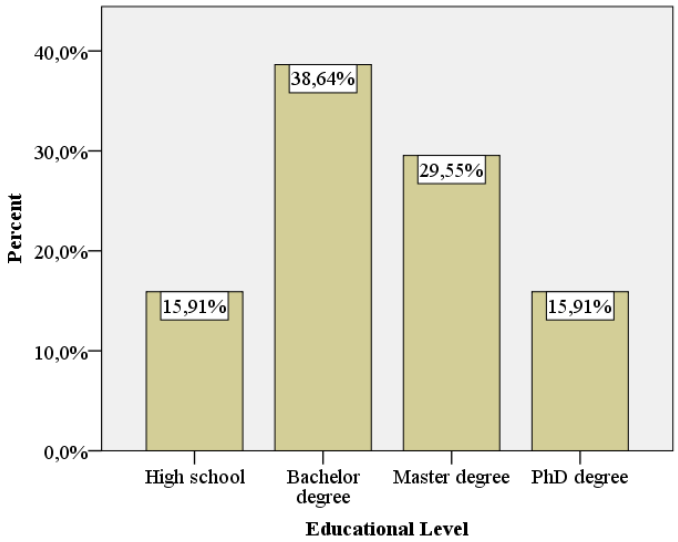

Figure 3.5: Educational level of the participants

As shown in Figure 3.6, 81.82% of the participants are students in Ankara, while the remaining participants are either visitors to higher education institutions or staff members. Furthermore, the participants indicated the higher education institution that they are a member of (see Table 3.2). A small percentage was chosen from Çankaya University in order to base the sample on unfamiliar subjects that would need to use the wayfinding tools available in the case study.

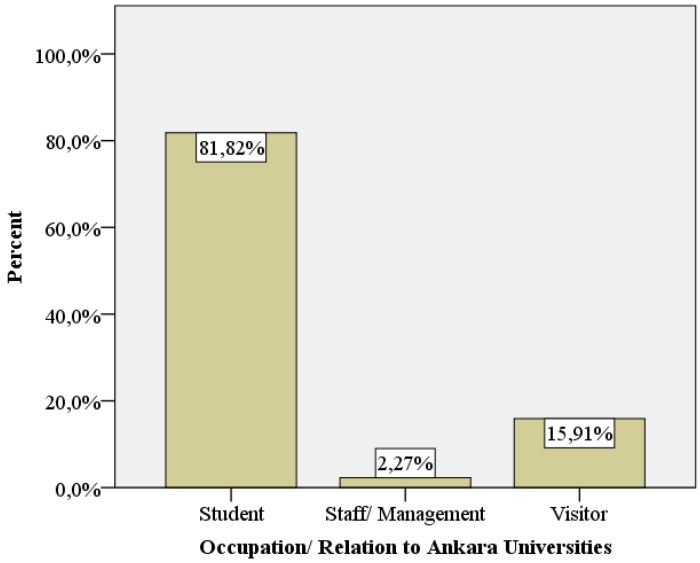

Figure 3.6: Occupation of the participants and their relation to higher education institution in Ankara

Table 3.2: Higher education institutions of the participants

University	No. of participants	Percentage (%)
Çankaya	2	4.5
METU	12	27.3
Atılım	15	34.1
Gazi	7	15.9
TED	5	11.4
Bilkent	3	6.8
TOTAL	44	100

The participants indicated if they had visited the Balgat campus of Çankaya University before. As shown in Figure 3.7, 63.64% indicated that this was their first visit to the campus, while 36.36% visited the campus at least once. Moreover, of the 16 participants who said that they had visited the campus before, 62.5% said that their frequency of visit was once in a year, while 12.5% visited the campus once in 6 months, as shown in Table 3.3.

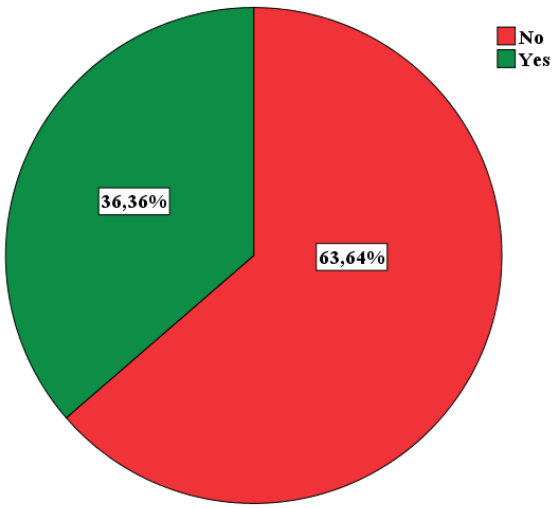

Figure 3.7: Participants indicating if they visited the university campus before

Table 3.3: Frequency of visit to the university campus

Visit Frequency	No. of participants	Percentage (%)
Once in a year	10	62.5
Once in 6 months	2	12.5
Once a month	1	6.3
More than once a month	1	6.3
Once a week	1	6.3
More than once a week	1	6.3
TOTAL	16	100

According to the questionnaire, the participants specified their purpose of their visits to the university; where 81.82% confirmed that they were visitors to the campus (Figure 3.8). Such an indication shows that the participants are unfamiliar with the campus site and they are depending on wayfinding tools and strategies implemented.

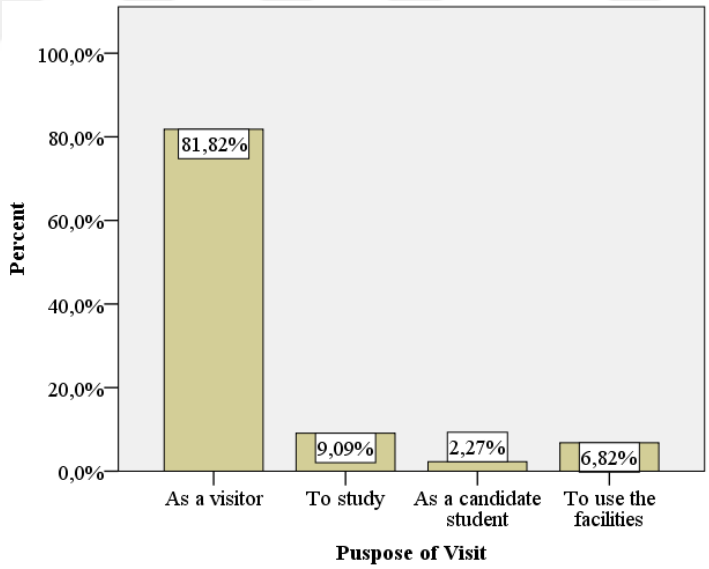

Figure 3.8: Purpose of visit to the university campus

Furthermore, 52.27% of the participants showed that they mainly used the Faculty of Law (Block A) entrance to access the building (see Figure 3.9), while 18.18% used the Faculty of Architecture (Block B) entrance. Nonetheless, 97.73% of the participants believed that they can exit the building from the same entrance they

used (see Figure 3.10). Furthermore, 45.45% of the participants stated that they prefer to ask students for directions to find destinations, while 40.91% prefer using information signs (see Figure 3.11).

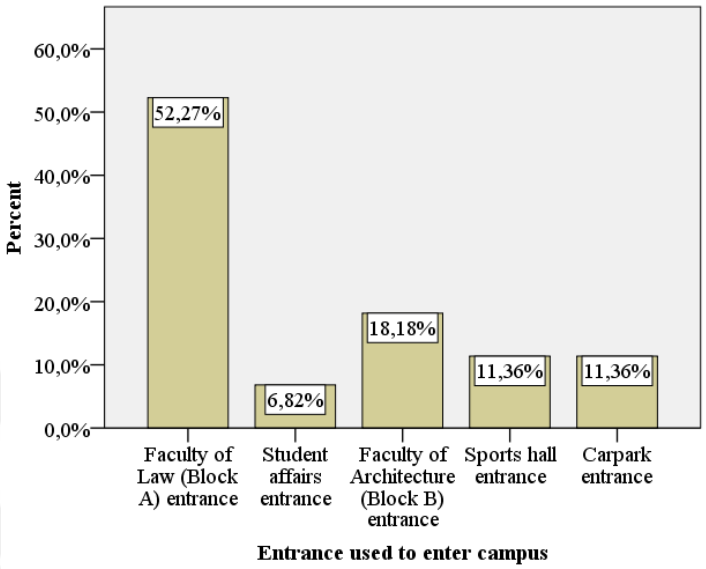

Figure 3.9: Entrance used to enter building by the participants

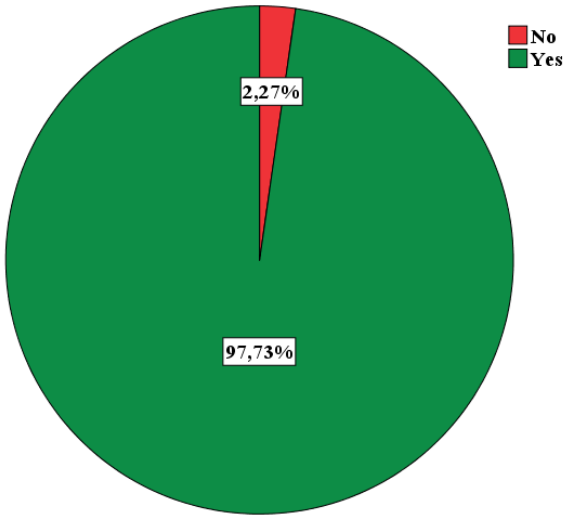

Figure 3.10: Participants' ability to leave the building from the same entrance they used

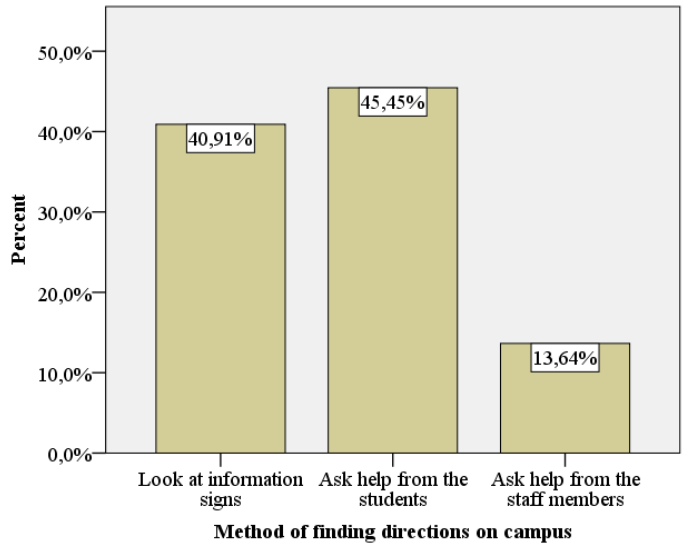

Figure 3.11: Method of finding direction in the building

Moreover, the results showed that 36.36% of the participant felt lost while performing the experiment (see Figure 3.12). These participants were asked to choose one or more reasons that made them feel this way. As illustrated in Table 3.4, the reason that "there are not enough information signs/ maps" have been chosen 66.7% of the cases, followed by "too many corridors" (44.4%) and "no color-coded information signs/ maps" (22.2%). Such results indicate that there are two main issues, which are the insufficiency of information signs and maps in the building, as well as a complex layout that caused confusion for the participants.

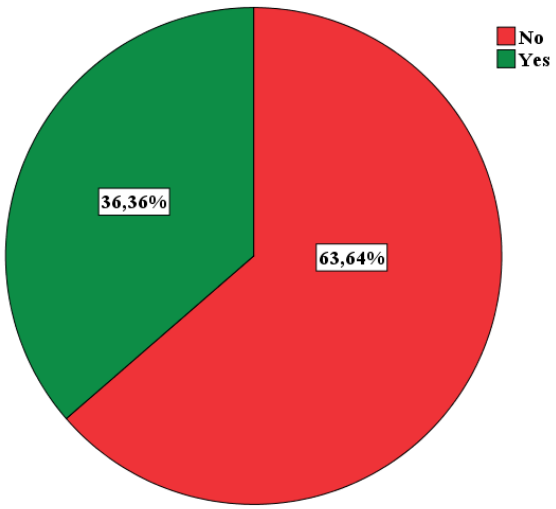

Figure 3.12: Participants' asked if they feel lost in the building

Table 3.4: Reasons for feeling lost in the building

Reason	Responses		Percent of cases (%)
	No.	Percent (%)	
Too many corridors	8	22.2	44.4
Too many entrances	2	5.6	11.1
Not enough information signs/ maps	12	33.3	66.7
Not enough information desks	3	8.3	16.7
No color-coded information signs/ maps	4	11.1	22.2
The information signs/ maps are not eligible	3	8.3	16.7
The information signs/ maps are not visible	3	8.3	16.7
I can't see the outside (no connection with exterior)	1	2.8	5.6
TOTAL	36	100.0	200.0

In order to test the visibility and availability of information signs, the participants were asked if they saw information signs. 29.55% of the participants said that they did not notice any information signs (Figure 3.13); however, only 22.73% of the participants indicated that the information signs currently available are sufficient (see Figure 3.14).

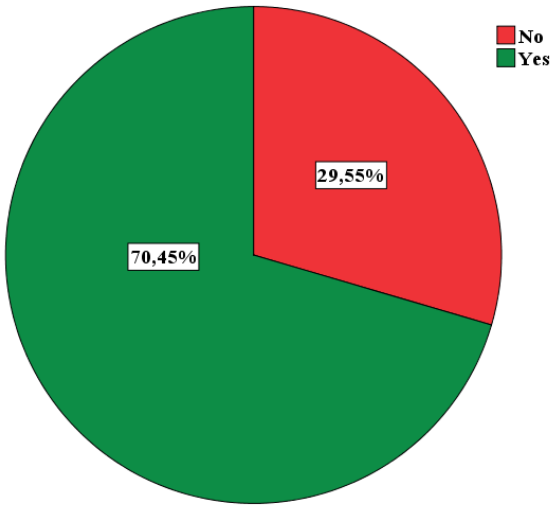

Figure 3.13: Participants' indication on the availability of information signs

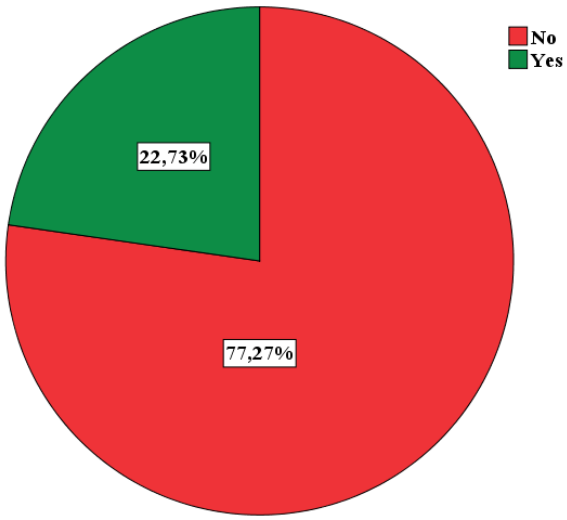

Figure 3.14: Participants' indication on the sufficiency of information signs

The participants believe that additional information signs should be added at the main entrance (54.5%) and at the beginning and end of the corridors (45.5%) (see Table 3.5). Furthermore, 63.64% of the participants indicated that they found it difficult to read the information signs in the campus (see Figure 3.15). When asked for the reasons, 50% of them said that the information signs are small, while 42.9% said that the information signs are not visible (see Table 3.6).

Table 3.5: Locations where participants believe information signs should be added

Location	Responses		Percent of cases (%)
	No.	Percent (%)	
At the entrance door	18	32.1	54.5
At the hallways	12	21.4	36.4
At the staircase hallways	11	19.6	33.3
At the beginning and end of corridors	15	26.8	45.5
TOTAL	56	100.0	169.7

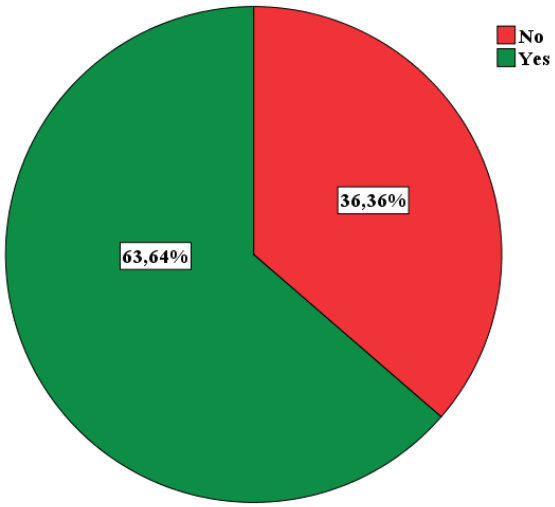

Figure 3.15: Participants' indication on the difficulty of reading the information signs

Table 3.6: Reasons for finding the information signs difficult to read

Reason	Responses		Percent of cases (%)
	No.	Percent (%)	
Very small	14	33.3	50.0
Very complex	6	14.3	21.4
Cannot understand the signs	10	23.8	35.7
Not visible	12	28.6	42.9
TOTAL	42	100.0	150.0

In the last question of the questionnaire, the participants indicated the difficulty level in finding the four destinations set for the experiment on a 5-point Likert scale of difficulty. As shown in Table 3.7, Destination D was found to be the most difficult destination with a mean score of 3.41. Destination D is the furthest point from the starting point and it is located on the ground floor towards the end of the main corridor. The second difficult destination was found as Destination B, which is located on the first floor and requires the participant to use the stairs to reach to it. These results show that the wayfinding tools provided do not support finding far destinations from the entrances' areas, in addition to difficulty in communicating destinations on different levels.

Table 3.7: Difficulty perception to find destinations

Destination	Mean	Standard Deviation
Destination A (Student Affairs office)	2.05	1.120
Destination B (Department of Interior Architecture)	2.41	1.041
Destination C (Copy room – Library)	2.18	1.206
Destination D (Graduate School)	3.41	1.168

In order to compare the means of different destinations, the optimal routes from the starting point were identified and the time that it required a person to reach the destination were measured, given that no wayfinding tools are required. The reference times were found as 61 seconds, 62 seconds, 71 seconds and 170 seconds for destinations A, B, C and D, respectively. As shown in Table 3.8 the average of the participating subjects collectively and according to their nationality are higher than the optimal times recorded by the researcher. Nevertheless, the time periods for destinations A, B and C seem to be higher for the Turkish participants in comparison with the Arab participants. Similar results were found for the times the participants got lost while finding the different destinations, as shown in Table 3.9.

Table 3.8: Mean time to reach destinations by the participants and comparison between Arab and Turkish participants

Destination	Sample Mean (Seconds)	Arabs mean (Seconds)	Turkish Mean (Seconds)
Destination A (Student Affairs)	86.61	77.38	97.70
Destination B (Department of interior architecture)	94.59	88.29	102.15
Destination C (Copy room – Library)	122.48	113.67	133.05
Destination D (Graduate School)	224.25	224.21	224.30

Table 3.9: Mean times lost until reaching destinations by the participants and comparison between Arab and Turkish participants

Destination	Sample Mean (Times)	Arabs mean (Times)	Turkish Mean (Times)
Destination A (Student Affairs)	0.64	0.21	1.15
Destination B (Department of Interior Architecture)	0.73	0.50	1.00
Destination C (Copy room – Library)	1.41	1.04	1.85
Destination D (Graduate School)	1.02	1.08	0.95

The analysis tables for this part are available in Appendix C. Through a One-Way ANOVA testing for significant difference between Arab and Turkish participants based on time to reach the four destinations and the number of times getting lost while finding them, there were no significant difference found based on time to reach destinations; however, there are significant differences in times getting lost between the two groups in destinations A and C, based on 95% confidence level ($p<0.05$), as shown in Tables C1 and C2.

Moreover, in testing the significant differences in destination finding difficulty based on nationality. Significant differences were found between the Arab and Turkish participants in finding destinations A, B and C (Table C3) based on a confidence level of 95% ($p<0.05$). A correlation test is further performed between the difficulty perception of the four destinations and nationality factor, as shown in Table 3.10. Medium negative correlations were found between the nationality factor and the difficulty perception level of destinations A, B and C, indicating that Turkish participants found these destinations more difficult.

Table 3.10: Spearman Correlations between destination difficulty perception and nationality factor, testing at $p<0.05$

	Nationality
Destination A	-0.581**
Destination B	-0.387**
Destination C	-0.398**
Destination D	0.100

*. Correlation is significant at the 0.05 level (2-tailed)
**. Correlation is significant at the 0.01 level (2-tailed)

The current wayfinding strategy that is implemented in the Balgat campus of Çankaya University consists of mainly small signage in Turkish language at the main lobbies of the building. However, these signs are neither well-distributed nor sufficient for different user groups to find their destinations within the campus. Based on the results of the questionnaire the current wayfinding strategy is not efficient and does not enable the users to reach their destinations in the shortest time possible and without getting lost.

In this research two hypotheses were tested in order to evaluate the efficiency of the wayfinding strategy in the university building, as well as indicate any significant differences between the user groups based on nationality.

H1: The current wayfinding strategy implemented at Balgat campus of Çankaya university is not efficient in terms of time to reach destinations and number of times getting lost. The participants cannot reach the destinations within the optimal times.

The optimal times recorded for the four destinations of the study were found as 61 seconds, 62 seconds, 71 seconds and 170 seconds for destinations A, B, C and D, respectively. Nevertheless, the timings found for the four destinations for the participants collectively and according to their nationality groups were far off these numbers. Therefore, this hypothesis is rejected.

H2: There is a significant difference between the Arab and Turkish participants in signage wayfinding based on times getting lost and time to reach destination or based on destination finding difficulty perception.

Based on times getting lost and time to reach destinations, there are no significant differences found by the ANOVA testing at a 95% confidence level (Tables C1 and C2) between Arab and Turkish participants. However, significant differences were found in the perception of destination finding difficulty for destinations A, B and C (Table C3). Therefore, this hypothesis is accepted based on $p<0.05$. The difference in wayfinding performance is confirmed through several studies in the literature. Lu and Bozovic-Stamenovic (2009) confirmed that different cultures use different wayfinding strategies. Bangel (2009) stated that different cultures use different terms in describing directions, which is also stated in the study of Hund and colleagues (2012).

4. CONCLUSION

The need for a methodology or a system to provide directions and instructions to space users led to the development of wayfinding, which its current concepts started to be formed in the sixteenth century. An efficient wayfinding system with appropriate tools became necessary as spaces evolved to be more complex and users have the need to reach their destinations with minimal time loss in a fast-track life. Moreover, assessing wayfinding systems extends beyond evaluating the system itself to understand the ability of the users to use the systems, interact with them and navigate through the environment. Therefore, factors affecting wayfinding are divided into architectural, graphical and individual factors. The architectural factors include the spatial legibility of the environment and the level of design complexity, while graphical factors refer to wayfinding tools that are implemented in the environment to assist users in their navigation. There are several individual factors that have different effects on wayfinding, such as gender, age and cultural differences. This study focused on the cultural differences of the participants.

The aim of this study is to evaluate the wayfinding strategy in the building at Balgat campus of Çankaya University, Ankara by measuring the time taken by users to reach certain destinations and the time lost during finding them. The study starts by understanding the different concepts that are associated with wayfinding through a thorough literature review. Spatial orientation and cognition are important concepts to understand as they determine the way users interact with the environment and the implemented wayfinding system. It mainly addresses the ability of the users to recognize and use landmarks and routes, and construct relationships between them.

Furthermore, architectural cues that are provided within the environment play a major role in the efficiency of the wayfinding system, which are divided as global and local cues. There are also three objectives that are set prior the design of a wayfinding system cue; creating a clearance and coherence between the different spaces around the built environment, forming a legible system for circulation and

founding an integrated communication system (Hunter, 2010). The global architectural cues are illustrated through the architectural legibility of the environment, which is measured through the ability of the structure to generate a wayfinding system in a way that enables the users to extract the necessary information from the environment and understand the way to navigate through it and circulate around its different parts. The efficiency of horizontal and vertical circulation, connection between the interior and the exterior and landmarks availability are all factors that contribute into increasing the legibility of the environment (Demirbaş, 2001).

Moreover, the ability of the users to use the environment through environments with different levels of legibility is described as spatial configuration, which is affected by the visibility, connectivity and layout complexity. Studies show that structure complexity has a high influence on user disorientation, while familiarity has a low influence. The spatial configuration of the structure is formed through five main elements; paths, edges, districts, nodes and landmarks (Najafpour et al., 2017). Nevertheless, there are local architectural cues that are provided to enhance wayfinding within the structure, which their type and location are influential in determining their effectiveness. Graphical cues are provided, such as maps and signs systems, according to the need for them and to facilitate a better navigation experience.

The literature showed that differences between individuals have impacts on wayfinding through different cognitive abilities, perceptions and capacities for information processing. Furthermore, studies showed that males and females have different preferences for wayfinding systems, while females experienced more anxiety during wayfinding experiments (Lawton and Kallai, 2002). As the ability to remember landmarks and form relationships between the different elements of the wayfinding system is essential for a better efficiency, age is found as a significant individual factor (Mishler and Neider, 2017). A few studies have also shown that differences in cultures, especially with different languages, impact the experience of wayfinding (Leib, et al., 2012).

In this research, an experimental methodology with a questionnaire was used to assess the wayfinding system available in the university campus. Twenty-four Arab and twenty Turkish participants participated in an experimental setting, where four destinations varying in distance and complexity had to be found within the campus and times to reach the destinations and times lost were measured. The process was followed by a questionnaire to enable participants to describe their experience in terms of difficulty and the challenges they faced through it.

The participants indicated that they would ask help from students to find their destinations (45.45%), while 40.91% indicated that they would use information signs. In general, 36.36% felt lost in the building mainly due to the lack of information signs and maps and availability of too many corridors. 77.27% of the participants said that the current information sign system in the campus was not efficient and more signs should be placed at the entrances, beginning and end of corridors and along the hallways. The participants described the signs as very small, not visible and not understandable.

In the destination difficulty evaluation by the subjects, Destination D, which is located on the far end from the used entrance and on the first floor, is described to be the most difficult. The destinations on different vertical levels were described as the most difficult, followed by the library destination (Destination C), which is located on the ground floor. The mean results of the experiment illustrated in Tables 3.8 and 3.9 show that Destination D has the highest time, followed by Destinations C, B and A, respectively. Furthermore, Destination C has the highest mean for times getting lost due to its complexity, followed by Destination D, B and A, respectively.

A statistical analysis is also performed to understand individual differences between the subjects based on nationality through one-way ANOVA testing with 95% confidence level ($p<0.05$). The results, which are shown through the Tables in Appendix C, show that based on the difficulty evaluation of the destinations indicated by the participants, significant differences were found between Arab and Turkish participants. A negative medium correlation was found in Destinations A, B and C based on nationality.

The results of the research show the need for further development for the wayfinding system in the building at Balgat Campus of Çankaya University, Ankara. More signs with visible and understandable graphics should be placed at the entrances, at the beginnings and ends of the corridors and along the corridors. The case study has several landmarks, which is considered an important factor in enhancing wayfinding; however, increasing the number landmarks may enhance the experience. Furthermore, future research needs to be conducted to understand the most effective wayfinding system designs through different colours, designs and graphics. In addition, age and gender differences can be investigated with respect to the usage of the wayfinding system. The difference between sign systems and maps can also be measured by applying the same methodology with the two different tools in order to find the differences between the two of them.

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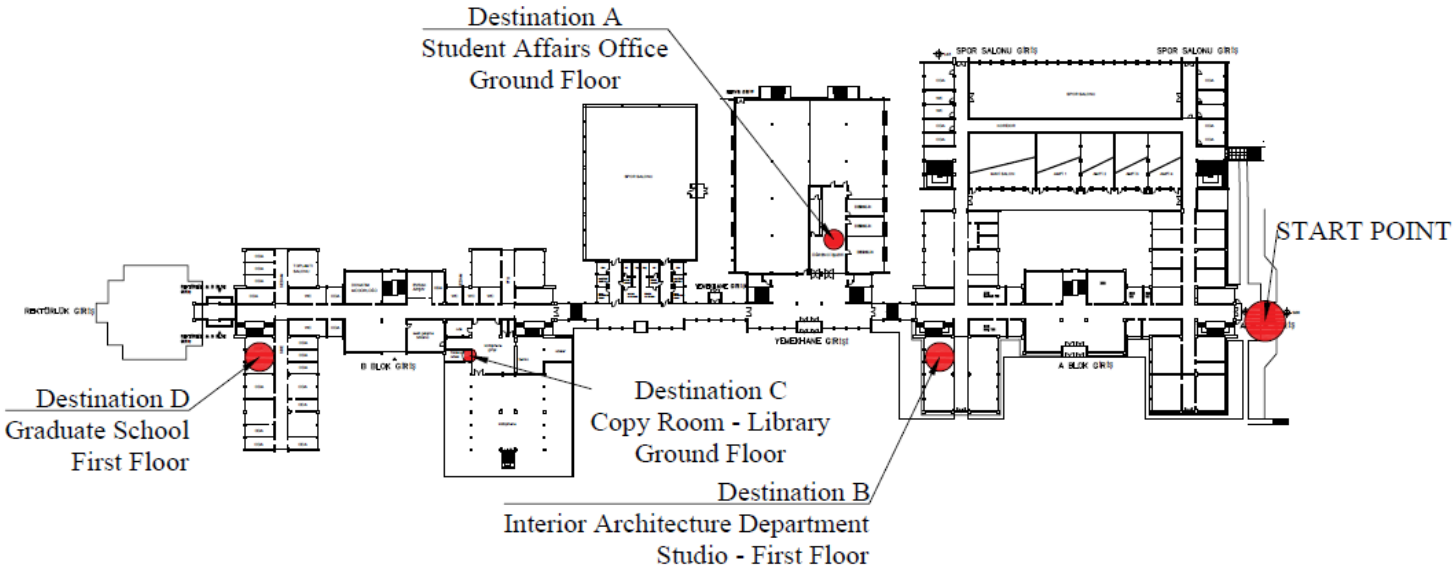
APPENDIX A

(RECORDING MAP)

Participant Results

	A	B	C	D
Times getting lost				
Time to destination				



GROUND FLOOR MAP

Participant Information

Number	
Ethnicity	

APPENDIX B

(QUESTIONNAIRE TEMPLATE)

Questionnaire on Wayfinding in Çankaya University, Balgat Campus

This questionnaire is part of a Master's thesis conducted at the department of Interior Architecture, Çankaya University. It aims to assess wayfinding in the Balgat campus of Çamkaya University. In this questionnaire, your personal information and your answers will be kept confidential. Your answers will be used only for academic purposes. Participation in this questionnaire is voluntary.

Part A: Demographics

1. Gender: Male □ Female □

2. Age :
   Below 18 □ 18 to 25 □ 26 to 33 □ 34 to 41 □ 42 to 49 □
   50 and Above □

3. Nationality: Turkish □ Arab □

4. Education Level:
   Primary school □ Middle school □ High school □
   Bachelor degree □ Master degree □ PhD degree □ None □

5. What is your relation (occupation) to higher education insitutions in Ankara?
   Student □ Staff/ Management □ Instructor/ professor □ Visitor □

6. In which university do you study/ work?
   Çankaya Uni. □ METU □ Atılım Uni. □ Başkent Uni. □
   TOBB ETÜ □ Gazi Uni. □ TED Uni. □ Bilkent Uni. □

Part B: Familiarity

1. Did you come to Çankaya University Balgat campus before? Yes □
   No □
   If yes, how often do you visit Çankaya University Balgat campus?
   Once a week □ More than once a week □ Once a month □
   More than once a month □ Once in 6 months □ Once in a year □

2. What is your purpose of visiting Çankaya University Balgat campus?
   As a visitor □ To study □
   As a candidate student □ To use the facilities (Library, sports hall, etc.) □

3. Which entrance of Çankaya University Balgat campus do you use the most?
   a. Faculty of Law (Block A) entrance
   b. Student Affairs entrance
   c. Faculty of Architecture (Block B) entrance
   d. Sports Hall entrance
   e. Car Park entrance
   f. Other (Please indicate).....

4. Can you leave the building from the door your entered? Yes □ No □
   If no, please explain .....

5. How do you find the place you are looking for inside the building?
   a. Look at information signs
   b. Ask help from the students
   c. Ask help from staff members
   d. Other (please indicate) .....

6. Do you feel lost in the building? Yes □ No □
   If yes, please choose one or more reasons for getting lost?
   Too many corridors □
   Too many entrances □
   Not enough information signs/ maps □
   Not enough information desks □
   No color-coded information signs/ maps □
   The information signs/ maps are not eligible □
   The information signs/ maps are not visible □
   I can't see the outside (no connection with exterior) □

7. In the building are there information signs Yes □ No □

8. Do you find information signs sufficient? Yes □ No □
   If no, where should the information signs be more? Please indicate all applicable locations.
   a. At the entrance door
   b. At the hallways
   c. At the staircase hallways
   d. At the beginning and end of corridors
   e. Other (please indicate) .....

9. Do you find difficulty in reading the information signs? Yes □ No □
   If yes, please indicate one or more reasons
   a. Very small
   b. Very complex
   c. Can not understand the sign language
   d. Not visible
   e. Other (Please indicate) .....

10. Please rate the difficulty level in finding each of the following destinations.

	Very Easy				Very difficult
Destination A (Student Affairs)	1	2	3	4	5
Destination B (Depart. of Int. Arch.)	1	2	3	4	5
Destination C (Library)	1	2	3	4	5
Destination D (Graduate school)	1	2	3	4	5

Thank you for your participation.

APPENDIX C
(ONE-WAY ANOVA ANALYSIS TABLES)

Table C1: ANOVA (Difference between Arab and Turkish Participants) – Time to reach

		Sum of Squares	df	Mean Square	F	Sig.
TimeA	Between Groups	4506,607	1	4506,607	3,735	,060
	Within Groups	50681,825	42	1206,710		
	Total	55188,432	43			
TimeB	Between Groups	2095,128	1	2095,128	1,402	,243
	Within Groups	62757,508	42	1494,226		
	Total	64852,636	43			
TimeC	Between Groups	4098,694	1	4098,694	1,545	,221
	Within Groups	111436,283	42	2653,245		
	Total	115534,977	43			
TimeD	Between Groups	,092	1	,092	,000	,997
	Within Groups	268762,158	42	6399,099		
	Total	268762,250	43			

Table C2: ANOVA (Difference between Arab and Turkish Participants) – Times lost

		Sum of Squares	df	Mean Square	F	Sig.
LostA	Between Groups	9,673	1	9,673	7,190	**,010**
	Within Groups	56,508	42	1,345		
	Total	66,182	43			
LostB	Between Groups	2,727	1	2,727	2,291	,138
	Within Groups	50,000	42	1,190		
	Total	52,727	43			
LostC	Between Groups	7,128	1	7,128	5,595	**,023**
	Within Groups	53,508	42	1,274		
	Total	60,636	43			
LostD	Between Groups	,194	1	,194	,122	,729
	Within Groups	66,783	42	1,590		
	Total	66,977	43			

Table C3: ANOVA testing for destination finding difficulty perception based on nationality

		Sum of Squares	df	Mean Square	F	Sig.
Dest A	Between Groups	18,201	1	18,201	21,408	**,000**
	Within Groups	35,708	42	,850		
	Total	53,909	43			
Dest B	Between Groups	7,128	1	7,128	7,578	**,009**
	Within Groups	39,508	42	,941		
	Total	46,636	43			
Dest C	Between Groups	11,837	1	11,837	9,804	**,003**
	Within Groups	50,708	42	1,207		
	Total	62,545	43			
Dest D	Between Groups	,928	1	,928	,675	,416
	Within Groups	57,708	42	1,374		
	Total	58,636	43			