Monitoring model for universal design in educational facilities

Seyed Mohammad Amin Alavi Tabrizi [a] *****, Yildiz Technical University, Turkey
Asli Sungur Ergenoglu[b], Yildiz Technical University, Turkey

Abstract

Universal design in architecture aims to achieve environments equal to all users. The philosophy offers solutions that are not mandatory to comply. In this study, a monitoring model for universal design is offered by analyzing universal design concept and; different standards and guidelines for accessibility in architecture, in this case focused on educational facilities. Additionally, it offers better environments for all the users in terms of access, security and health. Last but not least, the aim of the system is; to offer more than physical access by providing social inclusion. Two elementary schools are chosen as case studies for the trial of the monitoring system and to demonstrate the access levels of the schools together with the way to overcome the weaknesses to improve both the accessibility and education features.

Keywords: Accessibility, universal design, monitoring model, educational facilities.

* ADDRESS FOR CORRESPONDENCE: **Seyed Mohammad Amin Alavi Tabrizi,** Yildiz Technical University, Turkey.
 E-mail address: amin.alavi.t@gmail.com / Tel.: +90 212 383 70 70

1. Introduction

The notion of "universal design" (UD) was first made by Architect, Ronald L. Mace who has made it as a concept of designing built environment and products in order to be an answer for people's needs regardless of their age or disability. Mace believed that if a design could be barrier free for a person, it could also be designed to be barrier free for everyone. Just removing the barriers from the design would not be a complete solution to the problem and the designer has to broaden his horizon. In general, a clear definition about Universal Design, would be; design of products and built environments that allows everyone to use it equally to its maximum extent without having to make any adaptations or additional designs to the main one.

The study focuses on the accessibility of educational facilities in order to create better environments for all the students and staff. A review of accessibility legislations and guidelines are done to better explain the details of the proposed system. Using case studies and their results, the reliability of the system is also demonstrated.

2. Literature review

2.1. Americans with Disabilities Act

Americans with disabilities act (ADA) is a set of human rights laws which were legislated in 1990 and is being used since then. This series of laws are the most accepted standards for accessibility in architecture all around the world with periodical updates. The aim of these laws is to ban disability based discrimination in different types of activity areas or products. What ADA describes as disabilities are mental, physical, permanent or temporary. These laws are categorized in five titles which are demonstrated in table 1.

Table 1. Ada Titles

Title Number	Title
Title I	Employment
Title II	State and local government facilities
Title III	Public accommodations and commercial facilities
Title IV	Telecommunications
Title V	Miscellaneous provisions

Among the five titles the ones that cover most cases are titles 2 and 3. Both of these titles have a series of laws that refer to both new constructions and alterations to existing facilities. According to these five titles, every facility or the necessary part of it must be designed in such manners that would be accessible and useable to people with disabilities.

2.2. Universal Design

The aim of Universal Design concept is to make houses and products useable by everyone or most of the people without having make an alteration or adaptation. The difference between "universal design" and "accessible or adaptable design" concept is that, there are a set of standards in accessible design which refers to impaired people, but the target in universal design concept is all users despite of their age, size or abilities. In this concept, there are no specific targets for design, therefore there is no need to design for specific types of disabled people, and they are all included in design.

There are seven principles for universal design which was created in North Carolina State University and till today is the most complete definition of universal design which are given in table 2.

Table 2. Universal design principles

Principle	Design description
Equitable use	Useful and marketable to people with diverse abilities
Flexibility in use	Accommodates a wide range of individual preferences and abilities
Simple and intuitive use	Easy to understand, regardless of the user's experience, knowledge, language skills, or connection level
Perceptible information	Communicates information effectively to the user, regardless of ambient conditions or the user's sensory abilities
Tolerance for error	Minimizes hazards and the adverse consequences of unintended actions
Low physical effort	Used efficiently, comfortably and with a minimum of fatigue
Size and space for approach and use	Appropriate size and space for approach, reach, manipulation and use regardless of the user's body size, posture or mobility

2.3. Monitoring model for universal design

Unlike accessibility which seeks to eliminate physical barriers for the users, universal design not only aims to eliminate physical access but also creates an environment where there are no labeled and discriminated people because of their abilities. Universal design creates environments and facilities that treat its users equally, that everyone despite of their condition would be able to use the built environment equally. In order to reach such equal environments, access audits are created. The aim of every audit is to evaluate in order to improve, in this case, the improvement of accessibility. According to National Disability Authority (NDA), there are a number of definitions available for access audits such as:

- An access audit rates an existing building against given criteria for usability and accessibility. It involves not only the issue of ready movement to and around the building, but also the use by people with sensory or intellectual disabilities of the services, which the building provides (NDA, 2012).

- The access audit of a building and its setting is the starting point for a planned program of access improvements. Access auditing involves an inspection of a building or environment to appraise its accessibility – judged against predetermined criteria (NDA, 2012).

Before starting the audit and rating process of an existing or new construction, in order to make the correct judgment and rating the facility some data such as the occupier, the services provided, the life cycle of building, the budget and future plans for alterations should be collected. Collecting these data helps the assessor to make relative and effective recommendations for the users of that facility. For instance, what is required for a public facility may not be needed to provide in a private one with a smaller scale.

Assessment of the design is only one part of the total appraisal. The assessor has to be involved in all stages of construction in order to make a correct and complete evaluation and rating. The assessment includes three stages for the assessor:

- The design process,

- The construction level,

- And last but not least, the post-occupancy evaluation or POE.

The criteria should be assessed in the same order such as an algorithm. Meaning that each step is a prerequisite for the next step and without passing the minimum requirements of one main criteria,

the assessor cannot continue on the checklist. In order to pass each step of the main criteria, the design must meet the minimum requirements of each sub-category of that part. In the monitoring model; the requirements for these sub-criteria are collected with editions and alterations from universal design guidelines and accessibility standards such as ADA or DDA, etc. The merged form of standards with suggested guidelines into a system, created the monitoring model for universal design. Table 3. exhibits the main parts and headlines of the scoring card of the model

Table 3. Monitoring model for universal design

1	2	3	4	5	N/A	Criteria	Score
						1. Access to site	
						- Path of travel	
						- Materials	
						- Illumination	
						- Wayfinding	
						- Safety and warning systems	
						- Public transportation	
						- Comfort	
						2. Landscape	
						- Path of travel	
						- Materials	
						- Illumination	
						- Wayfinding	
						- Safety and warning systems	
						- Public transportation	
						- Comfort	
						3. Parking lot	
						A. Outdoor parking	
						- Path of travel	
						- Materials	
						- Illumination	
						- Wayfinding	
						- Safety and warning systems	
						- Comfort	
						B. Multistory and indoor parking	
						- Path of travel	
						- Materials	
						- Illumination	
						- Wayfinding	
						- Safety and warning systems	
						- Comfort	
						4. Entrance of facility and reception area	
						A. Entrance of facility	
						- Materials	
						- Illumination	
						- Safety and warning systems	
						- Door design	
						- Entrance design	
						B. Reception area of facility	
						- Path of travel	
						- Illumination	
						- Wayfinding	
						- Comfort	
						- Reception desk	
						5. Ground floor and horizontal circulation	
						- Path of travel	
						- Materials	

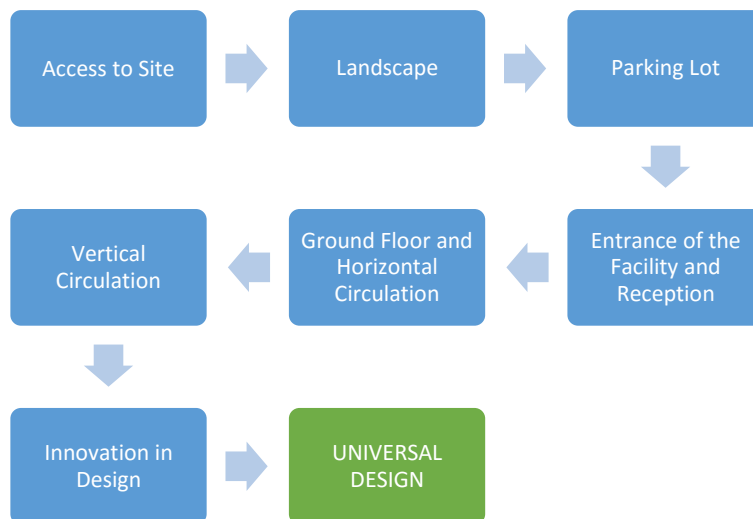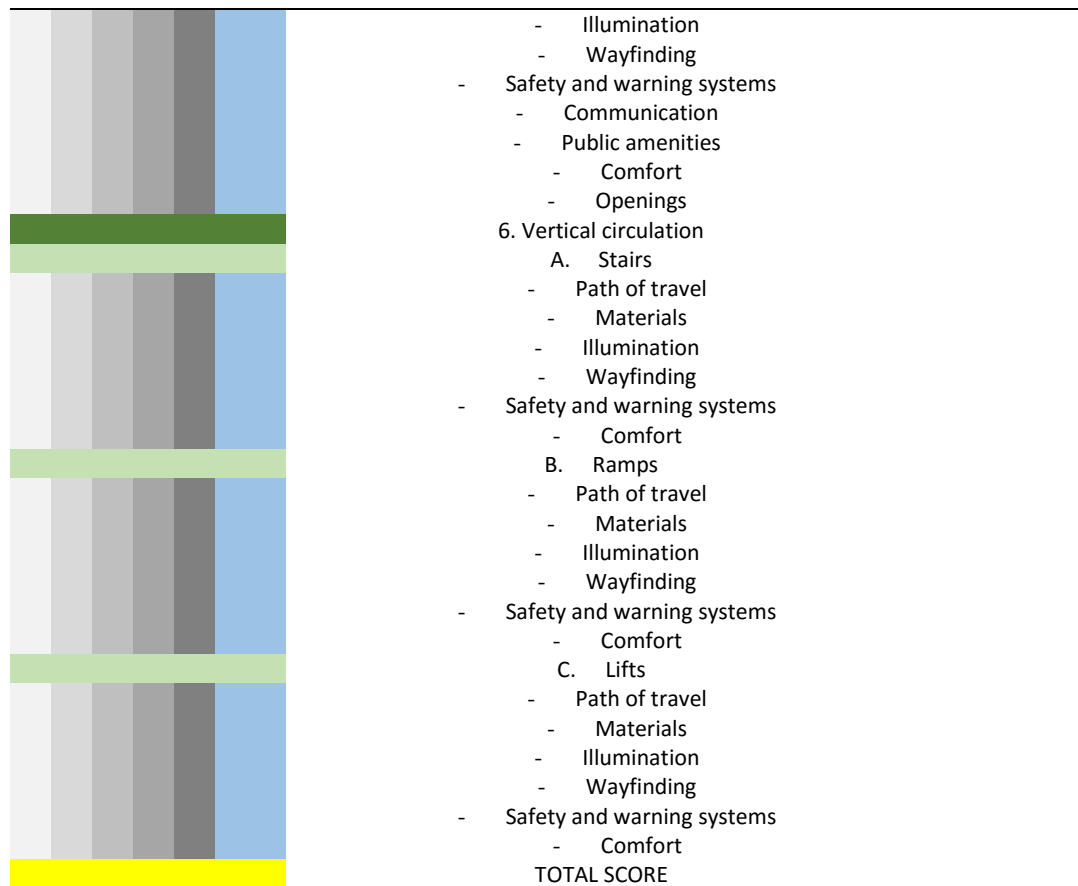|	
	- Illumination
	- Wayfinding
	- Safety and warning systems
	- Communication
	- Public amenities
	- Comfort
	- Openings
	6. Vertical circulation
	A. Stairs
	- Path of travel
	- Materials
	- Illumination
	- Wayfinding
	- Safety and warning systems
	- Comfort
	B. Ramps
	- Path of travel
	- Materials
	- Illumination
	- Wayfinding
	- Safety and warning systems
	- Comfort
	C. Lifts
	- Path of travel
	- Materials
	- Illumination
	- Wayfinding
	- Safety and warning systems
	- Comfort
	TOTAL SCORE

Figure 1. Universal design assessment procedure

One of the main goals for this assessment is to find out the weak spots for each facility, in order to create better environments for all users. It is also possible to rate only a specific part of the facility to find the weak points about that part. Additionally, with a system like this, it is possible to make a benchmarking.

3. The Trial of the Model: A case study on educational facilities

The objectives for the case studies are first of all; to present the model and its uses. Secondly; to examine the condition of the facilities and the accessibility level according to the standards and guidelines. Additionally, reports are given for each case showing the weak and strong points for each case and just by studying the reports users could learn about all the access features of the facility

Data collected was made via direct observation using the created access audit checklist. As mentioned; the access audit checklist was created based on universal design guidelines and accessibility laws. The audit can help to identify factors that might be barriers to all potential users. The audit is based on areas rather than function and as stated it acts as an algorithm. Last but not least, the scoring for each facility is based on its areas of function, meaning each building has its own top score. The procedure for assessment is demonstrated in figure 1. For the case study; two elementary schools are chosen from Istanbul Besiktas district. Gazi Mustafa Kemal and Cumhuriyet elementary schools which are referred as school A and B in the study.

3.1. Analysis and findings

The results of the study showed that school B (score 103 out of 220) provides better accessibility for users than school A (score 86 out of 214) which are demonstrated in table 4. and table 5. According to the proposed system, both these facilities are not fully accessible but, studying each part separately, it is understandable that school B meets almost half of the criteria, (46.81%) and school B meets around 40.18%. The best features that the facilities provided was, the entrances on both buildings, while the worst practice on both cases are the parking lots.
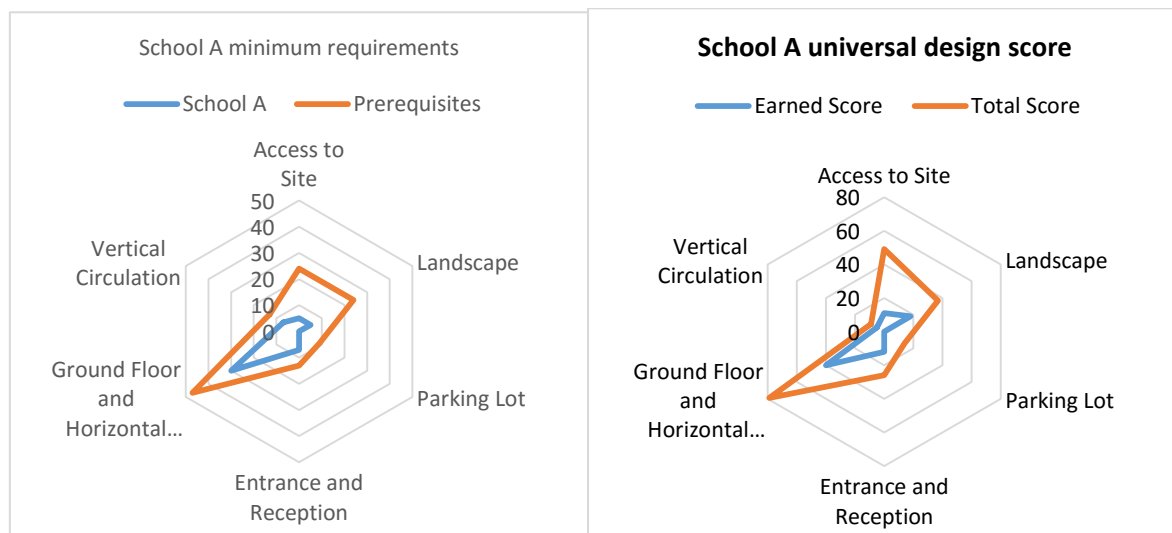
For both cases there were also some missing sub-criteria which has led to being not accessible such as the lack of wayfinding quality or non-existent tactile and braille warning systems.

Table 4. School A. access audit results

Sub Criteria	Access to Site	Landscape	Parking Lot	Entrance and Reception A	Entrance and Reception B	Ground Floor and Horizontal Circulation	Vertical Circulation A	Vertical Circulation B	Vertical Circulation C
Category score	11/49	18/37	0/14	12/26		40/79	5/9		
Path of travel	N	N	N				N	N/A	N/A
Materials			N		N	N	P	N/A	N/A
Illumination	N	N	N		N		N	N/A	N/A
Wayfinding	N	N	N		N	N	N	N/A	N/A
Safety and warning systems	N	N	N			N	N	N/A	N/A
Public transportation	N	N/A	N						
Comfort	N	N	N		N		N/A	N/A	N/A
Door design									
Entrance design									
Reception desk					N				
Communication						P			
Public amenities						N			
Openings						N			
TOTAL SCORE	86/214								

Table 5. School B. access audit results

Sub Criteria	Access to Site	Landscape	Parking Lot A	Parking Lot B	Entrance and Reception A	Entrance and Reception B	Ground Floor and Horizontal Circulation	Vertical Circulation A	Vertical Circulation B	Vertical Circulation C
Category score	18/43	17/33	0/14		8/27		41/80	19/26		
Path of travel	N	N	N					N	N/A	
Materials			N			N			N/A	
Illumination		P	N			N		N	N/A	
Wayfinding	N	N	N			N	N	N	N/A	N
Safety and warning systems		N	N		P		N	N	N/A	P
Public transportation		N/A	N							
Comfort	N	N	N			N		N/A	N/A	
Door design										
Entrance design						N				
Reception desk					N					
Communication							P			
Public amenities							N			
Openings							N			
TOTAL SCORE	103/220									

Category	Score	Accessibility Level
Access to Site	11	22.44%
Landscape	18	48.64%
Parking Lot	0	0%
Entrance and Reception Area	12	46.15%
Ground Floor and Horizontal Circulation	40	50.63%
Vertical Circulation	5	55.55%
Total	86	40.18%

Figure 2. School A report
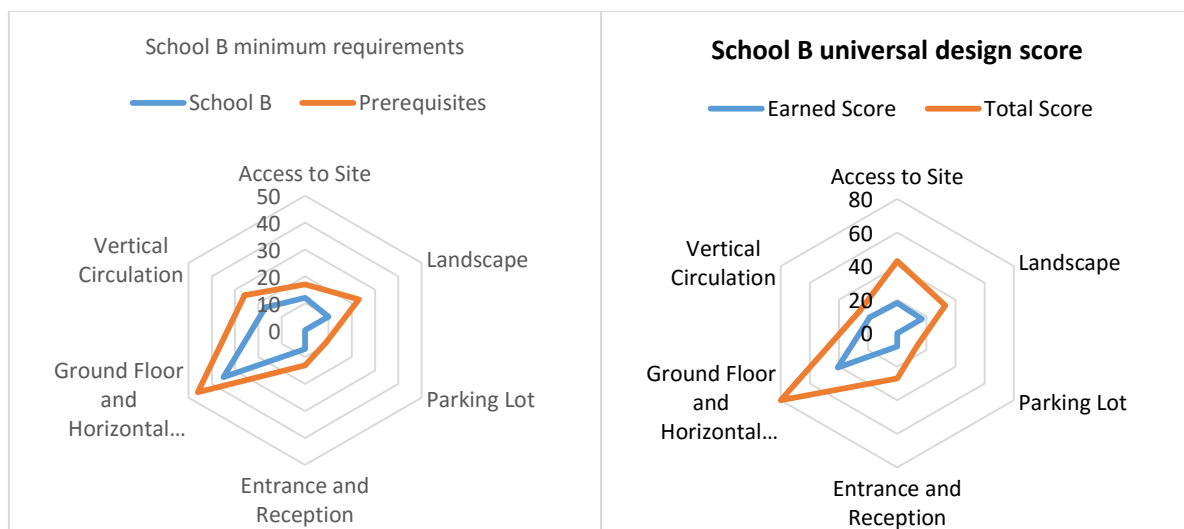
Category	Score	Accessibility Level
Access to Site	18	41.86%
Landscape	17	51.51%
Parking Lot	0	0%
Entrance and Reception Area	8	29.62%
Ground Floor and Horizontal Circulation	41	51.25%
Vertical Circulation	19	73.07%
Total	103	46.81%

Figure 3. School B report

4. Discussion and conclusion

All data was collected and examined with direct observations using the monitoring model system and the checklist. A simulation exercise using wheelchairs and blindfold was conducted instead of participation of real disabled persons which could have been more accurate but at that time, was not possible. Last but not least, the government did not allow the school managements to fully cooperate in this study which at the end, allowed the researcher to have access to limited spaces of both cases.

School B has features that allows access only to paraplegic persons aside of persons who do not face disabilities. While school A has insufficient access issues in almost every criteria and does not allow access to any kind of disabled person at all. Although both the managements claim that the reason behind this fault was budget. But as mentioned in this paper, universal design concept enables access with no extra cost. It is advisable for both building managements to plan and provide more human centered solutions in order to alter their facilities to be more accessible and universally designed for all current and future potential users.

In conclusion, the absence of such a system is sensible because, there are a lot of facilities that are in same condition as these two buildings. The most effective way to make universally designed, sustainable environments is the monitoring model. Additionally, a monitoring system helps the users to find facilities which are more suitable for them. For instance, in case B it is possible for a paraplegic person to circulate independently. Last but not least, the access audit could result in benchmarking which would automatically create a competition and a market place for building constructors, architects and real estates. An accessible or universally rated facility would be a more pleasant environment even for the able bodied.

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