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DIFFERENCES IN NAVIGATION BEHAVIOUR BASED ON LITERACY LEVELS WITHIN A TERTIARY HEALTHCARE COMPLEX IN NORTHWEST NIGERIA

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Navigation and wayfinding behavior pose significant problems especially in large healthcare institutional complexes worldwide. Such problems are aggravated by factors such as complexity, ageing, disease, gender, familiarity as well as literacy levels. Most studies regarding these problems are conducted in western healthcare environments, with little research efforts in developing countries such as Africa. This study evaluates navigation behavior based on literacy levels at Ahmadu Bello University Teaching Hospital Shika-Zaria, a large tertiary institution in Northwest Nigeria employing a questionnaire survey of 213 adults. Literacy is defined in this context as the ability to read and write in English. Respondents were requested to rate 20 navigation behaviors on six-point Likert scales. Results were analyzed in SPSS v21 for descriptive statistics and differences in ratings based on literacy using independent samples Mann-Whitney tests. Results reveal that overall, literate and illiterate respondents employ route mapping behaviors related to memory recall, use of shortcuts and verbal descriptions more than other categories. Apart from basic navigation steps for known routes ($p=0.387$), the remaining categories record significant differences based on literacy levels (route mapping $p=0.005$, spatial orientation $p=0.016$, route perception $p=0.029$), with the most significant difference recorded for basic navigation steps for new routes ($p=0.001$), which rely on reading signs and symbols, asking for verbal directions and using instinct. The results also reveal that literate respondents employ basic navigational steps and spatial orientation more than route mapping and route perception, which record higher mean ratings by illiterate respondents. To cater to all users, design solutions need to enhance and encourage elements of basic navigation and spatial orientation such as use of landmarks, clear positioning of help desks, placement and design of context specific signage and symbols as well as clear entrances and exits.

Keywords: healthcare complex, literacy, navigation, northwest Nigeria, wayfinding

INTRODUCTION

In most papers and research material, navigation and wayfinding are often used interchangeably. Wayfinding, often referred to as a total process of moving

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through, within and around a space, involves not just directional but cognitive and route mapping skills that have overall effect on user's performance within a space (Golledge, 1999). Navigation involves finding routes between pairs of locations, traveling and receiving continuous real-time guidance while on a chosen route. The basic objective of the average user in a space is to navigate within and around the space to a desired destination. Despite these unique features, this paper references wayfinding and navigation as they were defined previously; other times they are employed interchangeably. Being such a complex process, navigation is difficult in large built environments such as the health care facilities (Huisman, Morales, Van & Kort, 2012). These facilities provide a level of health care services within one a large organic system. They typically are large, complex and evolving spaces, which are regularly reconfigured and extended as operational needs shift and change, often resulting in a confusing, non-systematic layout (Li, Brown, Pinchin & Blakey, 2015). Ido, Heylighen and Pintelon (2016) report that patients, who are likely to be under stress, have to navigate their way to multiple locations in the course of a single visit resulting in a problem. Architectural solutions to navigation problems in complex environments are mostly based on the principles of spatial cognition, circulation planning and signage. In order to enhance the ease of navigation especially around auxiliary facilities within the building, signage is usually employed in the common language (Ufuk, 2000). Each country or state has a common language employed. In Nigeria the formal language used is English. Despite this, States in Northern Nigeria for many years have lagged behind in English literacy, according to data on literacy index recently published by the National Bureau of Statistics (NBS) (Ajibola, 2017). Additionally, signage in hospital environments are often presented in medical expressions in English not commonly known or understood by people who do not have experience with medical terminology and who are not conversant with the written English language.

Despite massive funding over decades, literacy level remains very low in Northern States of Nigeria. Kaduna State in particular has a literacy level of 47.31% (Ajibola, 2017). According to Maina and Dauda (2017), there is a deviation in the order of effectiveness of these architectural solutions to navigation problems in low literate zones in comparison with the research conducted in the higher literate zones in foreign countries. In spite of these findings, no research has been conducted to objectively evaluate the extent and impact of this deviation due to the literate ability of the users in the study area. In light of this, this study will first identify and understand navigational issues literacy causes for users of hospital spaces and then to examine its relative significance and impact (Gibson, 2017). These results will in turn provide a user driven, evidence base upon which to improve existing navigational aids and/or inform new forms of adaptive, locative guidance (Jerrod, 2017). The overall aim is for such improvements to significantly reduce everyday navigational inefficiencies and improve the overall 'user experience' for patients, visitors and staff alike. As the study entails an objective evaluation on literacy as an influencing factor on way finders' navigation in tertiary health care facilities in Northern Nigeria, Ahmadu Bello University Teaching Hospital Shika, Zaria Kaduna State (ABUTH) was chosen as an example of a tertiary health care facility in Northern Nigeria.

REVIEW OF RELATED LITERATURE

The concepts of wayfinding and navigation are very prominent in the field of design. This is as a result of the dire need to find more effective solutions that go beyond the regular practice of using conventional signs and symbols and the need to gain understanding into how users carry out the task of finding their way in and out of a building (Arthur & Passini, 1992). By this standard, decision making during this process usually involves the initial motivation to find somewhere with a specific purpose and destination. As a principle it was first defined by Lynch in 1960, where he referred to use of maps, street and directional signs as way finding. The first era in the development of way finding witnessed the inception and conceptualisation of way finding, dominated by thinkers keen to study cognitive structures responsible for information processing (Lynch, 1960; Downs & Stea, 1973; Siegel & White, 1975; Kaplan 1976). Way finding was understood in terms of cognitive maps and spatial orientation (Umar & Maina, 2015). The second era had way finding concepts advanced by extending of spatial orientation. Thinkers such as Passini (1977, 1984, 1996); Wiesman (1981), Arthur and Passini (1992) who were keen to study the dynamism of human space led this era in which way finding was explained in terms of spatial problem solving. The third era saw an extensive application of existing concepts. Researchers such as Downs and Stea (1973) and Kaplan (1976) were part of thinkers that agreed with the theory that people form cognitive maps of their surroundings, acquiring, storing, and refining information in a schematized and structured form and laid emphasis on the navigational behaviour of the users during the entire process (Maina & Umar, 2015).

Consequently, large volumes of design principles/guidelines relating to wayfinding and navigation have been produced over the years. Symonds (2017) outlined basic process of way finding in four stages: Orientation (as the attempt to determine one's location in relation to objects that maybe nearby and the desired destination), Route decision (as the selection of a course of direction to the destination), Route monitoring (as the checking to make sure the selected route is heading towards the destination), and Destination recognition (when the destination is recognised).

Foltz (1998) developed four basic principles of way finding. These include the creating the following: identity at each location, different from all others, well-structured paths, regions of differing visual character as well as providing signs at decision points to help way finding decisions.

Another set of principles was developed by Heulat (2007) whereby the author asserts from the building blocks that facility amenities, graphics, signage, architecture, interior architecture, interior design, landscape and master plan rely on each other to form a solid way finding system.

A closer examination of these principles and many others similar shows that way finding is largely explained in terms of spatial orientation and cognitive mapping involving desired routes. A notable criticism of these approaches however is the tendency to focus on human perception and information processing with less attention given the built environment within which wayfinding and navigation occurs. Additionally, cognitive mapping and externalised spatial knowledge is

difficult to assess and measure reliably. Due to this, experimental research on cognition of both indoor and outdoor navigation increased greatly following the work done by Passini in the 1970s. Thorndyke and Hayes-Roth (1982) established a fundamental principle that spatial information acquired from maps was fundamentally different from spatial knowledge acquired from walking through indoor spaces. This early work provided the field with many of the techniques still used today (Karimi, 2015). Based on the basic concepts of way finding as reviewed by many scholars it is assumed that the basic goal during any way finding process is to navigate through, within and around a built environment and subsequently arrive at a destination. Some scholars such as Hirtle et al. (2011) argue that even though textual signage is as useful as graphical signage for assisting navigation, complex buildings are difficult to navigate regardless of signage. Typically, tertiary health care facilities require sophisticated technology, multiple specialists, sub specialists, a diagnostic support group, and intensive care facilities (Farlex, 2007), and are known to be a converging point for people from a wide range of backgrounds; from the upper class and highly exposed to the lower class and unexposed who are all seeking medical attention within a single facility.

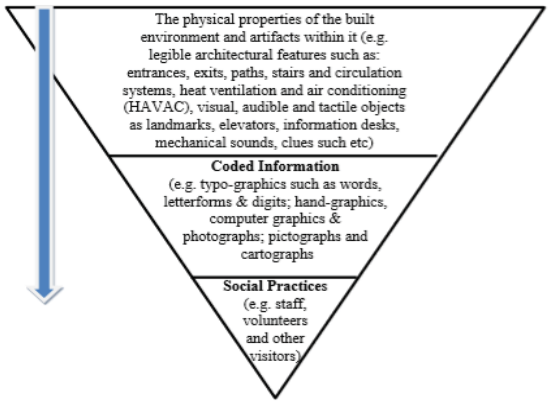

Figure 1: Prescriptive framework for addressing way finding problems. Source: Rooke (2012).

Moreover, medical language may be inconsistent from facility to facility. Signage is not always clear and does not accommodate those who are unable to read English or those who cannot read at all (Cooper, 2010). In order to objectively understand navigational behaviours within a built environment one must look at the way finding concept as a whole and the variables that influence it, in addition to basic principles that are solutions to its difficulties. In light of this some scholars have developed strategies providing solutions to way finding problems. A prominent example is the work of Rooke (2010) comprising a framework providing a prescriptive review to the standard strategies and solutions of way finding problems. Figure 1 illustrates the order of importance of strategies that coded information (usually involving words, letterforms, photographs etc.) is given a greater priority than the vocal strategies involving social practices (e.g. staff, volunteers, other visitors etc).

Based on the prescriptive framework, some would critique that in situations where way finding solutions using coded information designed to aid effective navigation fail due to users being unable to comprehend the signs, symbols and written instructions provided to ease navigation. In that case, the nature of the prescriptive framework (figure 2) would change as posited by Maina & Dauda (2017).

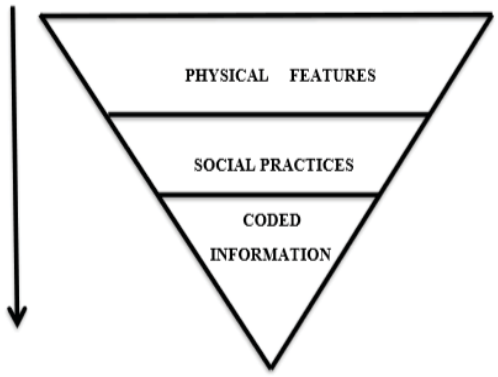

Figure 2: Modified framework for addressing wayfinding difficulties. Source: Maina & Dauda (2017).

In this study Maina and Dauda (2017) evaluated way finding solutions in a low literate study area (North east Nigeria), and discovered that use of components for wayfinding practices was ineffective due to users' inability to read and coherently understand coded information and signage. Written signage being most concerned with the user's educational ability to read and understand a coded message, creates a link between the navigational performance of a user and his cognitive ability.

Traditionally there are no universal definitions and standards of literacy. Unless specified, all rates are based on the most common definition; "the ability to read and write at a specified age" (Soria, 2018). However, in modern times the term has been expended to include the ability to use language, numbers, images, computers, and other basic means to understand, communicate, gain useful knowledge (UNESCO, 2006). The concept of literacy is expanding in most countries to include skills to access knowledge through technology and ability to access complex contexts. Based on the population census carried out in the Report of the National Literacy Survey (2010), North East Nigeria had the least literacy rate in English language whereas North Central had the least literacy rate in any language.

The Wayfinding Questionnaire (WQ) was evaluated as the starting point for developing a screening instrument of navigation-related issues in the current study. The WQ contains 26 items (Claessen et al., 2016). For the purpose of this study the WQ was modified to ease analysis with close-ended questions on 20 items rated on a 6-point Likert scale. Based on the 20-item questionnaire a 4-factor structure for navigation was adopted and is explained below.

- Route mapping

A route is a behavioural pattern describing the path someone takes from an origin to a destination; it covers a directed movement activity (Klippel & Ritcher, 2004; Montello, 2009). Route mapping as a factor analyses a user's ability to remember a path and their tendency to form a mental map of the space in which their moving and use it to direct themselves along a path leading to a destination. Route mapping abilities influence overall success of navigation tasks (Klippel, 2004; Montello, 2009; Marquardt, 2011). The Wayfinding (WQ) analyses this ability through the following statements:

- I can usually recall a new route after I have walked it once.
- I can easily find the shortest route to a known destination.
- I am good at giving descriptions of routes I've passed before.
- When giving route descriptions I describe based on features I remember.

- Spatial orientation

Spatial abilities are used to manipulate geometric information to determine location related to the environment (Rudolph & Barry, 2014). Spatial orientation also involves the ability to coordinate and re-orientate movement within a space. The most important aspect of spatial orientation is self-location, the ability to relate where you are in the real world to the corresponding spot on a map or in your memory (Maxwell, 2013). The WQ evaluates this by assessing user's responses through the following close ended questions:

- When I enter the facility for the first time, I can easily point to the main entrance.
- I can orient myself quickly and correctly when I enter an unknown environment.
- I always try to orient myself in a new environment.
- In an effort to orient myself I panic.
- When I get lost I get nervous.
- When I get lost I try to re-orient myself.

- Basic navigation steps for known and new routes.

The basic objective of the average user is to arrive at a set destination (Rudolph & Barry, 2014). Basic navigation steps vary depending on whether the user is taking a known or new route, which are largely dependent on the user's route navigation and spatial abilities. Successful wayfinding occurs when the navigator can make correct navigation decisions that take him from his present location to a destination that fulfils his larger purpose (Golledge, 1999). The steps are evaluated by the following statements in the WQ:

- When trying to find my way I pay attention to landmarks.
- When trying to find my way I rely on instinct and follow the flow of movement.
- When trying to find my way I try to find a help desk or staff to talk to.
- When trying to find my way I try to understand the area and read the signs around.
- When taking new routes I rely on instinct.
- When taking new routes I openly observe signs and symbols.
- When taking new routes I openly ask for help from people around.

- Route perception

Route perception is a process through which humans and other organisms become aware of the relative positions of their own bodies and objects around them along a specified path (Reginal, Roberta & Jack, 1996). Route perception provides cues, such as depth and distance, that are important for movement and orientation along

an unknown path. These cues in turn affect how a user reacts when navigating through a route. In addition to affecting a user's instinctive reactions along the route it also affects the impressions a new route makes on the user's mind and how they would approach it in future. (Montello, 2009) The WQ assesses the user's responses upon taking a new route through a few statements:

- I enjoy taking new routes (for example shortcuts) to known destinations.
- When taking new routes I panic.
- I avoid new routes entirely.

Based on the four-factor navigation structure explained above, this study aims to objectively:

- Evaluate if there are any real time effects of literacy on way finder's navigation abilities.
- Determine from the results obtained what aspects of a user's navigational abilities show a greater variation in user performance and the inferred implications.

METHODOLOGY

Ahmadu Bello University Teaching Hospital (ABUTH) being a typical example of a tertiary health care facility located within a low literate zone in Nigeria was chosen for this study. It is located in Shika, Zaria, Kaduna State, Nigeria. Even though the most current research strategies for investigating navigational skills involve mapping out user routes and behaviours with tracking devices during experiments, fire alarm checks and virtual reality simulations, implementing these strategies was not possible due to several reasons. Training a large number of users in the use of tracking devices requires extensive time and most virtual reality analysis equipment are exorbitantly priced, making access to such equipment difficult, putting it beyond the financial resources and scope of this research. In light of this a mixed method approach was employed for the study, involving the collection of data by questionnaires, participant observation and visual surveys. The visual survey was conducted to properly ensure that the selected case study area met all requirements of a tertiary health care facility with 4-factor way finding variables adapted from the WQ. Basic navigations steps were however presented in two categories-basic navigation steps for known routes and new routes, producing five sets of factors (Tables 3 and 4). The visual survey commenced at the entrance of the main hospital facility and involved a brief interview of random users and staff in order to document the prominent features they noticed and utilised during their navigational tasks. They were asked to identify and confirm the use of each variable:

- Physical features (Entrances, stairs, corridors and building routes etc, Plates 1 and 2)
- Social practices (Help desks and staff, Plate 5)
- Signage and coded information (Text directions, signs, codes, arrows, Plates 3 and 4).

Plate 1: Corridor as a physical feature within the hospital. August 2018

Plate 2: Public staircase within the hospital. August 2018

Plate 3: Signage within the hospital. August 2018

Plate 4: Signage to the payment centre within the hospital. August 2018

Plate 5: Help desk in the entrance lobby, an example of social practices. August 2018

MATERIALS AND METHODS

Data from WQ responses were obtained from patients, staff and visitors. The study population comprised of a random selection of people within the hospital environment; ranging from patients, staff to visitors, of the "Adult" age as defined for the National Literacy Survey (2010) to be persons aged 15 years and above by the time of the survey, and who were available at the time of the distribution of the questionnaires and were willing to participate. According to the records gotten from the Statistics department within the hospital, an average of 650 patients are attended to per day. Sample size was determined from Yomens (2000) using the formulae:

$$n = N / 1 + N(e2)$$

where N is population size, n is sample size, e is margin of error (0.05)

The above calculation resulted in a sample size of **248**.

In order to ease distribution and retrieval of questionnaires, 3 field assistants were recruited, all of whom are English literate and fluent in the local language of the study area (Hausa). 248 questionnaires were distributed at random at the case study location over a period of 6 days, of which 213 (86%) were retrieved. The Questionnaires were distributed in hospital areas that according to Human Resources and Statistics Department of the hospital, received the highest concentration of users coming in and out of the hospital environment. These areas were the General Out-Patient Department (GOPD) and the Accident and Emergency Department (AnE). This was done in order to get a more dispersed user distribution and because the two areas received the highest number of first time visitors to the facility. In situations where correspondents were not literate in the language (English) used for the questionnaire, survey was done verbally in English or the native language which in all instances was Hausa and later filled into the questionnaire by the field assistants and/or head researcher. This was done for a total of 87 questionnaires all of which were retrieved. In most cases extra time was taken to explain the questions in depth to the illiterate participant, in order to better perceive navigational behaviours. To increase random accuracy of the survey, questionnaires were shared to both genders and all user categories at random. After compilation and analysis of user data, mean values (M) and Relative Agreement Index (RAI) of all navigation behaviors were obtained from respondent's ratings. RAI is calculated as a ratio of actual scores and number of responses (N) multiplied by the maximum possible score (Martin, Hirdes, Fries & Smith, 2007), six on a six-point likert scale. The maximum value for RAI is 1. Mid point values for Mean equal to or above 3 and RAI of 0.5 were considered important for navigation and wayfinding in this study. To establish if significant differences exist between responses from literate and illiterate respondents based on the four categories, independent Mann-Whitney U tests were employed. Mann-Whitney U tests for differences between values obtained from two different groups when those values are not normally distributed (Field, 2013). Test results are significant in this study if the p value is less than 0.05. Results from these analyses are presented in the next section.

RESULTS

The research was conducted across a three-category (patient, staff and visitor) user, distributed at random producing the demographics below.

Table 1: User category distribution

	Frequency	%
Patient	33	15.5
Staff	81	38.0
Visitor	99	46.5
Total	213	100.0

The frequency distribution for literacy reveals approximately 65% of respondents are literate (Table 2), compared to approximately 35% who were not.

Table 2: Literacy Category among users

	Frequency	%
Adult Illiterate	74	34.7
Adult Literate	139	65.3
Total	213	100.0

Notably all respondents were analyzed without disparity, and distribution across genders and ethnicities was neutral and random. Subsequently analysis and results were conducted without any provisions being made for gender or ethnical based differences.

Results addressing the first research aim reveal significant differences in responses between literate and illiterate respondents, with the notable exception of basic navigation steps for known routes (p=0.387, Table 3). In essence, both literate and illiterate respondents did not significantly differ in their ratings of Basic navigation steps for known routes related to the use of signs, symbols and reliance on instinct. The highest degree of difference occurred for basic navigation steps for new routes (p=0.001) which involve the use of verbal communication, use of landmarks as well as following the flow of movement. Interestingly, mean ratings for basic navigation steps for new routes are higher for literate users than for illiterate users, implying that literate users in the study area rely on asking for verbal instructions even when they can read and understand signs and symbols as opposed to illiterate users of healthcare facilities. Illiterate respondents recorded higher mean values for route mapping and perception (Table 3).

Table 3: Differences of ratings for literate and illiterate users

Categories of Navigation Behaviors	M All	M Literate	M. Illiterate	U	p value
Route Mapping	4.77	4.63	5.05	3,935	0.005*
Basic Navigation steps in a known route	4.38	4.40	4.34	5,511	0.387
Basic Navigation steps in a new route	4.35	4.47	4.11	6,528.50	0.001*
Spatial Orientation	3.69	3.78	3.52	6,170.50	0.016**
Route Perception	3.50	3.40	3.68	4,215.50	0.029**

**Sig. at 0.01, **Sig. at 0.05*

In response to the second research aim, results reveal that overall, literate and illiterate users employ route mapping behaviors related to memory recall, use of shortcuts and verbal descriptions more than other categories. Results presented in Table 4 reveal that all but three navigation behaviors record mean values below 3 and RAI less than 0.5 which relate to panic situations in route navigation and spatial orientation. A possible reason for this may have been the negative phrasing of the statements, the meaning of which may have been misconstrued during the process of translation.

Table 4 Ranking of navigation behaviors from literature based on RAI

Navigational behavior	Category	N	Sum	M	SD	RAI	Rank	M Lit	M. Illit
I can usually recall a new route after I've walked it once	RM	21	1058	4.97	1.399	0.83	1	4.72	5.43
I'm good at giving descriptions of routes I've passed before	RM	21	1049	4.95	1.289	0.82	2	4.83	5.16
When giving route descriptions I describe based on features I remember	RM	21	1026	4.82	1.224	0.80	3	4.78	4.89
When taking new routes I openly ask for help from people around	BNSii	21	968	4.54	1.703	0.76	4	4.60	4.45
When trying to find my way I try to find a help desk or staff to talk to	BNSii	21	965	4.53	1.600	0.76	4	4.53	4.53
When trying to find my way I pay attention to landmarks	BNSii	21	960	4.51	1.393	0.75	6	4.54	4.45
When I get lost I try to re-orient myself	SO	21	956	4.49	1.200	0.75	6	4.55	4.38
When I enter the facility for the first time, I can easily point to the main entrance	SO	21	940	4.41	1.427	0.74	8	4.43	4.38
I always try to orient myself in a new environment	SO	21	934	4.38	1.282	0.73	9	4.44	4.28
I can easily find the shortest route to a known destination	RM	21	925	4.34	1.414	0.72	10	4.17	4.66
When taking new routes openly observe signs and symbols	BNSi	21	925	4.34	1.786	0.72	10	4.50	4.04
When taking new routes I rely on instinct	BNSi	21	904	4.24	1.497	0.71	12	4.09	4.53
I can orient myself quickly and correctly when I enter a new environment.	SO	21	897	4.21	1.397	0.70	13	4.26	4.12
When trying to find my way I rely on instinct and follow the flow of movement	BNSii	21	894	4.20	1.310	0.70	13	4.11	4.36
When trying to find my way I try to understand the area and read the signs around	BNSi	21	885	4.15	1.878	0.69	15	4.71	3.12
I enjoy taking new routes (for example shortcuts) to known destinations.	RP	21	853	4.00	1.784	0.67	16	4.22	3.61
I avoid new routes entirely	RP	21	784	3.70	2.027	0.62	17	3.33	4.39
When taking new routes I panic	RP	21	592	2.78	1.859	0.46	18	2.64	3.04
When I get lost I get nervous	BNSi	21	585	2.75	1.691	0.46	19	2.94	2.38
In an effort to orient myself I panic	SO	21	545	2.56	1.666	0.43	20	2.61	2.46

RM=Route Mapping, BNSii=Basic Navigational steps in a new route, SO=Spatial Orientation, BNSi=Basic Navigation steps in a known route, RP=Route Perception

DISCUSSION

The results from Table 4 suggest greater reliance on independent navigation and wayfinding behavior than a dependence on asking for verbal instructions. This is an unexpected finding due to the fact that this trend is expected of literate users, not illiterate respondents. It appears that illiterate users have a tendency to rely on individual and independent route mapping abilities, implying a greater dependence on architectural features of the environment for navigational tasks. This means that users would tend to pay more attention to physical cues around them, to aid self-orientation during a navigational task. Architectural and environmental features could enhance route mapping and route memory retention through landmarks and other features which help aid more self-reliant respondents.

Also evident even in the situation of the literate user, was the reliance on social practices, due to the fact that the practice of asking verbal instructions is entrenched within the socio-cultural milieu of Nigerians even within highly educated environments (Maina & Umar 2015; Maina & Dauda, 2017). In this situation such users tend to ignore environmental cues and landmarks and rely on signage as well. This generates a need for improved signage systems, preferable pictorial and graphic signage that does not rely on a particular language but is universally interpreted. Consequently, these social practices could be enhanced to enable a greater ease of interaction within the built environment.

A large percentage of illiterate users show greater reliance solely on individual abilities and independent social practices. This was an unexpected finding as visual observation illustrates illiterates are likely to ask for directions and not be independent in finding their way around new or complex environments. Some illiterate users interviewed however explained this conundrum: reliance on individual abilities was done to avoid being labelled inexperienced or naïve due to their inability to read and write in the English language employed for hospital signage.

CONCLUSION AND RECOMMENDATIONS

A close analysis of the results reveals an impact on effectiveness in the use of architectural differentiation and environmental cues in the study area. This being true due to the socio-cultural attitude of the people in the study area as well as the ineffectiveness of signage and coded information employed in the facility, due to their inability to read and comprehend the written language. Passini, Proulax and Rainville (1990) emphasise the physical environment has a major role in compensating for deficiencies in signage and coded information, thus architectural design of the physical environment is paramount. Marquardt (2011) also stresses that while cues such as signage and distinctive features can support wayfinding, they cannot compensate for a poor plan layout. Thus, in order to cater to all users, these considerations need to be made during and after the design process:

- Distinct landmarks should be incorporated in to hospital design of new and existing facilities in low literate zones.
- Clear positioning of help desks and pictorial signage around entrances and, help and security personnel to aid the common socio-cultural attitude of most of the respondents in this study.
- Simple architectural layouts, avoiding excessive repetitive elements like long corridors and monotonous columns, dead ends and complex corners and turns. This would create an open space for ventilation catering for the hot climate of the region and in turn provide comfortable open, relatively easy to navigate environments for more self-reliant respondents.
- Spatial overview opportunities so that individuals can view a building's layout from various vantage points, in order to re-orient themselves in the event of getting lost.
- Further studies to improve and implement signage systems to compensate for low literate areas are necessary for generalisation of results.
- Further studies regarding impact of literacy on other aspects of way finding like spatial perception.

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