

Architectural Considerations towards Improving Deaf Education

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Abstract

The Deaf community in South Africa have made some progress in fighting for educational rights. However, Deaf/Hard of Hearing (DHH) learners are not being placed in schools due to a lack of specialised/integrated schools and mainstream schools lacking staff, understanding, and sensitivity to appropriate architectural design. Deaf-Space presents a culturally responsive design approach catering to DHH needs and experiences of space. This study explores how the nature of „Deaf-Space” and „Deafness” influences a school's architecture for the Deaf, aiming to engage the positive roles that the built environment may play towards Deaf learners educational, social and emotional development. A qualitative interpretative methodology was chosen to examine teachers' perception of the school built environment and its effect on DHH learners' educational/social needs. Semi-structured interviews with 7 participants were conducted. Remote data collection occurred during September 2020. Thematic Analysis was used to identify themes and subthemes from meaning units within the data. The themes identified were Learning Environments, Social Environments, Functional Environment and Engagement with Environment. This study establishes that „Deaf-Space” and „Deafness” have critical influences on developing a school's architecture for the Deaf, in respect of accommodation, lighting, acoustics, and materiality. Further findings are that incidental learning has a vital role in Deaf learning and that schools act as cultural nodes promoting social exposure for the Deaf community. Future research should explore architecture as a means of incidental learning for the Deaf.

Keywords: Deaf-Space; School Architecture; Deaf Education

1. Introduction

The important role of architecture in shaping the experiences and outcomes of education is widely recognized yet often disregarded. Research suggests the importance of sensory perception as crucial to the way buildings are experienced as either positive or negative. It is therefore critical to understand how the experiences of Deaf/ Hard of Hearing (DHH) learners are impacted by their unique sensory perception.

The purpose of this study was to explore the perception and spatial challenges of learning spaces by DHH learners through the lived experiences of the teaching staff at a school of the Deaf/Hard of Hearing.

The study contributes towards understanding the role of architecture in providing inclusive Deaf Education. The study establishes critical aspects of architectural design that impact DHH learning; providing criteria towards Deaf friendly architecture that could be implemented in the development of learning spaces of Schools for DHH.

The holistic development of Deaf children is severely affected by the lack of normal linguistic and cognitive skills. These deficits in development impact on access to education as well as becoming productive members of society as adults [1]. School environments developed with minimal consideration of experiences by children with sensory challenges can negatively impact the overall development of the children as well as their everyday experience of learning and school which often lead to social problems later in life [1]. In contrast, research indicates how architectural design that is responsive to the DHH perception of learning spaces can lead to a positive experience of education and improve the development of these children [2, 3].

The term DeafSpace refers to architectural design that responds to the unique requirements of persons who are Deaf or Hard of Hearing[5]. This approach falls under the broader scope of Universal Design which aims to develop architecture that considers the range of abilities presented by people with ‘disabilities’[4]. At present, the most popular example of „Deaf-Space” is the Deaf Space Project started by architect Hansel Bauman at Gallaudet University, a University for the deaf and hard of hearing in the United States [7].

In South Africa, the Deaf community are recognised as a linguistic-cultural minority; with the education of DHH children categorised as specialised education. Unfortunately, the current provision of specialised schools for Deaf learners seems to be woefully inadequate as indicated by the school pass rate of 28% in 2016 This could be attributed to a shortage of Deaf teachers, lack of foresight or adequate funding by the Government, as well as a lack of understanding and accommodation of the needs of deaf scholars [8]. There are several misunderstood aspects of being d/Deaf or hard of hearing (DHH) which are explored in this study.

Our sense of sound is vital to the way we perceive space and architecture and how we communicate and move around. When one is deaf, a primary experience of and communication within the environment is through line of sight and visual access [10]. The Deaf community in South Africa has made some progress in fighting for educational rights. For example, South African Sign Language (SASL) has been incorporated into the National Senior Certificate curriculum in 2018, SASL is set to become the 12th official language of the country [11]. Many DHH learners find themselves in mainstream education where they are often exposed to learning environments without sensitivity to their sensory needs. Deaf learners in mainstream education are more prone to drop out of school [8]. However, the needs and experiences of DHH learners can be accommodated through the implementation of the concept of DeafSpace, which in turn provides a more inclusive learning environment for all children [7].

An initial review of the literature showed little focus on architecture within Deaf schools and the associated needs of the Deaf population within primary and secondary education. Beyond the need for an increase in Deaf schools to cater to the Deaf population, there is an imperative to implement Deaf friendly design into existing specialist schools, as they lack architecturally responsive spaces catering for the needs of their Deaf learners [12]. The research challenge is understanding how Architecture can improve the quality of spaces for

these learners. Deaf friendly Architectural design is generically known as Universal Design, and more specifically as „Deaf Space” [5]. The primary research question is thus: How can the nature of „Deaf-Space” and „Deafness” influence the architecture of a school for the Deaf?

The paper will further provide an overview of the Theories and Concepts; explain the Methodology; discuss the literature review

2. Theories and Concepts

The theories and concepts of this study are overarching philosophical assumption of ontological nominalism. What one considers “real” is an interpretation of one’s physical and social experiences throughout life, based on inner thoughts, cultural background and subjectivity [13, 14]. Moreover, phenomenology and existentialism walk hand in hand in exploring one’s experience of “reality” [15, 16]. This study loosely explores phenomenology as derived from the philosophy of Heidegger [15] and through an architectural lens established by Norberg-Schulz [17] explores the connection a person has with their environment, and through an educational lens explores how one learns. Figure 1. presents the theoretical framework, branching into two groups, phenomenology of architecture and education.

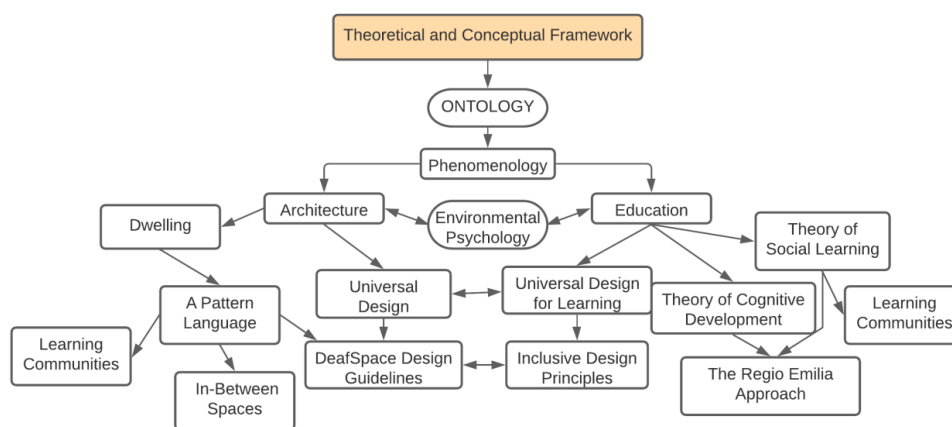


Figure 1. Theoretical and Conceptual Framework

3. Methodology

Our study design is based on qualitative with an Interpretivist methodology. We aimed at exploring teachers’ lived experiences within a Deaf specialist school [18]. Thematic analysis of primary and secondary data sources is used to establish relevant theories and identify themes [19]. A case study of a School for the Deaf, which will be named School A; describes teaching staff perceptions of factors within the built environment that enhance or hinder the educational and social development of Deaf learners within the school. Due to the COVID-19 pandemic and the restrictions on movement placed by the Government of

South Africa, this study’s primary sources were adapted for remote data collection only; no face-to-face/physical contact-based research was conducted. Primary data collection was conducted following ethical approval. All data was anonymized.

The study’s philosophical underpinning adopts an „Interpretivist” ontology according to which reality is subjective and based on individual experiences. Within this Interpretivist paradigm, the researcher acknowledges that one’s interpretation is shaped by one’s own experiences and background [13, 18]. The qualitative approach adopted is frequently applied within the Interpretivist paradigm [18]. In line with Interpretivism, understanding the context is critical to

interpreting data [18]. This study was conducted in the province of KwaZulu-Natal, South Africa. The eThekweni Metro was chosen as the area to conduct the study as this is the largest urban area within KwaZulu-Natal (KZN). KZN, one of nine provinces in SA, has the largest school learner population, approximately 2,8 million learners [20, 21]. A qualitative research approach of the case study was chosen, as it allows an in-depth examination of a subject and is open to the multiple realities of participants [13]. A thematic approach was used to collect data utilising semi-structured interviews.

The participant's relevance to the research topic determines their selection in qualitative studies rather than their representativeness [13]; therefore, purposive sampling was used to identify participants based on the researcher's knowledge of the population. Teaching and assistant teaching staff in the school who could offer information to best answer the study question were invited to participate in the study to collect various experiences and maximise the potential of a semi-structured interview [13, 14]. For this qualitative study, a sample size of 8, from the possible pool of 34, was considered to be adequate in answering the study's research question. Due to data saturation, the interviews were stopped at a sample size of 7. School A's target population comprised 20 teachers and 14 teaching assistants, all from multiple ethnographic and socio-economic backgrounds. As some participants were Deaf/ hard of hearing, a professional SASL interpreter was employed and assisted in interpreting signing.

An initial examination of secondary data, in the form of text/ narrative, pictures/ illustrations and graphs, was conducted consisting of the following methods and sources:

Following an examination of secondary data, a case study was conducted at School A, KwaZulu-Natal. The data of this study is presented through a thematic analysis following text/narrative. 3D experience of the school's spaces is critical to gaining a contextual understanding [18]. Due to COVID-19, the researcher had to rely on information gained through the remote interviews as access to the school for photographic documentation of the architecture was not allowed, and information attainable online is limited.

Semi-Structured Interviews - To assist in answering the study objectives of (1), what teacher's perceptions of spatial challenges within a Deaf learning environment are, and (2), how can architecture within a Deaf learning environment respond to deaf school learners' needs; core questions were used within semi-structured interviews. The interviews consisted of a list of open-ended questions informed by the study's objectives [13].

The interviews were recorded with visual/audio devices and were subsequently transcribed verbatim in text. The individual transcriptions were reviewed by participants for confirmation of the accuracy and to allow an opportunity to add any other response in the process of member validation [14]. Most participants did not offer any new contributions, with only one participant adding to the original transcript.

Thematic analysis was used to code data obtained from each interview, dismantled, and reassembled in an inductive and iterative process [13]. Data extracts were identified, followed by condensation and coding in categories [19, 25]. Data extracts were colour coded, with related phrases identified with assigned colours. Information not related to the study topic was omitted.

4. Literature Review

The literature review followed a scoping review methodology to limit the range of sources to focus on objectives. A range of categories raised within the studies reviewed was identified as relevant to answering the objectives. An incremental increase in recognition of principles was seen, with early studies showing less mention of significant principles than more recent studies (see Table 1).

The role of Deaf Space is primarily explored in the literature as the physical relationship with one's environment and secondarily the social/cultural relevance associated with interaction in the built school environment. The results indicate that visual access, lighting, acoustics, and materials affect DHH learners' education. However, there are knowledge gaps between the two primary professions identified in the literature, Education and Architecture, indicating a lack of in-depth cross-field examination. While this may not be relevant to each study's specific objectives, it could limit the outcome as the fields share a symbiotic relationship regarding the practical education of the Deaf.

The theoretical framework expanded on the theories and concepts introduced in the literature review exploring theoretical concepts of the ontology of Deafness and the relationship to one's environment, particularly that of schools as cultural nodes for the Deaf community.

5. Research Findings

The themes and sub-themes extracted from the data were reviewed and presented in a narrative that captures the participants' interpretations and experiences. Participant contributions are rich and relate to the study objectives 1) Explore and describe the perception of spatial challenges identified by teachers within a Deaf learning environment and 2) Develop an understanding of how architecture within a Deaf learning environment could respond to the needs of deaf School learners.

Presentation of Findings: The participants' contributions led to the exploration and condensation of many codes used to identify emerging sub-themes within meaning units; these codes themselves could be considered the development of sub-sub-themes. There was an undeniable thread relating to the Covid-19 pandemic in participant contributions. Although this was not anticipated when planning this study, it would be remiss to exclude this.

Table 1. Identified Categories from Literature

Authors	Objective 1: Components of Architectural provisions made within the school environment											Objective 2: Components of spatial challenges related to the needs of deaf learners					
	Architectural Principles	The Principles of Universal Design	Inclusive Design Principles	DeafSpace Design Guidelines	Access	Lighting and	Acoustics	Materials	Learning Spaces	Cultural Spaces	Technology	Visual	Acoustic	Mobility	Social	Organisational	Additional
(Abdel-Maksoud, 2016)	✓	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	-	-	✓
(Bednarczyk et al., 1994)	-	-	-	-	✓	-	✓	✓	✓	-	✓	✓	✓	-	✓	✓	-
(Childress, 1985)	-	-	-	-	-	✓	✓	✓	-	-	-	✓	✓	✓	-	-	-
(Guardino and Antia, 2012)	-	-	-	-	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓	✓
(Johnson, 2014)	✓	-	-	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	-	-
(Malik et al., 2018)	✓	✓	-	-	✓	✓	-	-	-	-	✓	✓	-	-	✓	-	-
(Martins and Gaudiot, 2012)	-	-	-	-	✓	✓	✓	✓	✓	-	✓	✓	✓	-	-	-	-
(Mitchiner et al., 2018)	✓	-	-	✓	✓	✓	-	✓	✓	-	✓	✓	-	-	-	-	-
(Pedersen, 2013)	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	-	-
(Priestley, 2006)	✓	✓	-	-	✓	-	✓	-	-	-	-	✓	✓	-	-	-	-
(Tsymbal, 2010)	✓	-	-	✓	✓	✓	-	-	-	✓	-	✓	-	-	-	-	-

Four principal themes provide a narrative within the participant's responses towards answering the study question. The transcripts were reviewed to ensure all data had been considered and that no new themes or sub-themes could be identified and that the research question had been answered [25]. There were instances where one meaning unit could belong to multiple themes in which case the context of the extract would determine the theme. The interview data are resulted in four main themes: i. Learning Environment. ii. Social Environment, iii. Functional Environment and iv. Engagement with the Environment

5.1. Learning Environment

The Learning Environment theme arose from the participants' responses describing aspects that affect learning environments for the DHH. Participants described how Deaf children learn, the importance of learners being able to see hand signing, the challenges of teaching in a school where Deafness was not the only difficulty that learners had to overcome, and the unforeseen but significant effects the

Covid-19 pandemic had on movement through the learning environment.

Deaf Learning- Participants explained that signing is the language of the Deaf (South African Sign Language, SASL). They found that many children who came to the school had not communicated with others as they had never managed to learn any language, let alone SASL. Participants suggested that children, who were unable to hear, missed out on incidental learning. This was explained as an essential part of the learning experience. Participants spoke of ways to encourage visual learning within the school environment.

Visual Access- Participants emphasized the importance of eye contact. Participants were concerned that window placement often made seeing projected images very difficult.

Lighting- Participants stated that lighting was important when teaching Deaf learners. One participant suggested that skylights might provide more natural light in the classroom.

Additional Challenges- Participants said that they had to consider that learners may have learning challenges in addition to their Deafness.

The Effect of Covid-19 on the Learning Environment- Participants explained that public health recommendations during the Covid-19 pandemic meant that the school had to implement measures to comply with social distancing. Participants explained that taking

masks off is necessary to effectively teach, as facial movements supported signing. Social Environment-Participants explained Deaf culture and the challenges

of exclusion that Deaf learners may experience. They discussed the effects of the Covid-19 pandemic on the social environment within the school.

Table 2. Thematic Data Analysis Process

Meaning Unit/Data Item	Codes	Sub-Themes	Themes
An extract from the transcript/data set	Initial identification for grouping of meaning units	Condensation of Codes into relevant Sub-Theme	Identified Theme from Sub-Themes.
“One of the disadvantages for Deaf kids is that they don’t learn incidentally, so they don’t hear their parents chatting about stuff... They can’t ask questions like, who’s that person that you’re talking about? Or where did that happen? So, for me, a suitable learning environment is one where you can find a balance between content knowledge and incidental learning, and creating a pretty peaceful space that you... that you can learn in. That, I think... I think, that the biggest challenge, is trying to find that balance.” P1	Incidental Learning Communication Comfort Learning Challenges Balanced Education	Deaf-Learning	Learning Environment

5.2. Social Environment

The social environment theme arose from the participants' responses that discuss aspects that affect social environments for the DHH. Participants explained Deaf culture and the challenges of exclusion that Deaf learners may experience. They discussed the effects of the Covid-19 pandemic on the social environment within the school.

Deaf Space - "... for me Deaf space would be the signing space that a... that a Deaf learner uses. Just... so, the entire frame in front of a Deaf learner would be their signing space. And then obviously if the Deaf learner is, or a Deaf person is signing in a social gathering, they would need space around them, because they... they are quite expressive in terms of the use of their hands. And they do get quite emotional if they want to show something or exaggerate certain things when they are out in a social gathering.” Participant 3

Exclusion - Participants said that Deaf children sometimes felt excluded and expressed how delayed language development impacts Deaf children. A participant felt that the school had to be a homely place and that this was especially important for Deaf learners who might feel rejected by their families because of their disability.

The Effect of Covid-19 on the Social Environment - Participants explained how the Covid-19 pandemic had changed how learners interact with each other. Participants explained that the extra-curricular activities had to change.

5.3. Functional Environment

The functional environment theme arose from the participants' responses describing aspects that affect social environments for the DHH. Participants discussed how the classrooms affected teaching Deaf learners. They talked about how they envisaged the development of the school and the need for ongoing maintenance. They explained how the Covid-19 pandemic had impacted the school.

Accommodation- A participant spoke about corridors and corners. Participants said that the school facilities were spread over large grounds. Participants explained that learning areas were uncomfortable at times because of varying temperatures. Participants said that the classrooms needed to be spacious to accommodate teaching and learning needs. Participants explained that learners often required attention for health needs. Participants said that they needed to move

Table 3. Themes and Sub Themes examples of Thematic Analysis

Themes	Sub Themes
Learning Environment:	
This theme arose from the participants' responses describing aspects that affect learning environments for the DHH. The sub-themes were;	Deaf Learning
	Visual Access
	Lighting
	Additional Challenges
	The Effect of Covid-19 on the Learning Environment
Social Environment	
This theme arose from the participants' responses that discuss aspects that effect social environments for the DHH.	Deaf Space
	Exclusion
	The Effect of Covid-19 on the Social Environment
Functional Environment	
This theme arose from the participants' responses describing aspects that effect social environments for the DHH	Accommodation
	Development

the boarding facilities for the younger learners, away from the administration block.

Development- A participant said that any changes should be undertaken following consultation with the Deaf. Participants felt that the school needed to grow, but that this had certain challenges, in particular with staffing. Participants said that the school would benefit from additional facilities. Participants felt that the boarding facilities needed to be expanded.

Maintenance- Participants said that funding changes sometimes happened, but that generally, this was an ongoing challenge. Participants expressed challenges of maintenance in the school.

The Effect of Covid-19 on Functionality- Participants explained how the Covid-19 pandemic affected the running of the school. Participants said that although the Covid-19 pandemic affected some aspects of development, there was an instance where a long-overdue project was carried out. A participant stated that the school had lost income that was usually obtained from hiring out the School Hall to the community.

5.4. Engagement with Environment

The engagement with environment theme arose from participants' positive responses that indicated explicitly or implicitly that they are happy or proud of the learning environment they helped create, directly or indirectly. Participants shared their feelings about their working environment.

Pride and Ownership- Participants said that the School Hall was a very useful space. Participants felt that they worked in a beautiful space and that the

grounds were beautiful. Participants said that having small classes made it easier to manage the classrooms. Participants said that the three phases of the school had ample playgrounds and recreational areas.

The semi-structured interviews allowed an in-depth understanding of the functioning of the school with relation to the educational and social needs of the Deaf learners within the three phases of schooling: Foundation Phase (ages 3 to 9), Intermediate Phase (ages 10 to 12), and High School (ages 13 to 18). Participants described factors that facilitated learning and factors which were felt to be an impediment to the optimal teaching process.

6. Discussion

The Case Study themes and subthemes within the context of the literature examined within the scoping review, other relevant literature, and information gained from the precedent studies; according to the study's objectives and considers the context of the underpinning theory of phenomenology.

Theme i - Learning Environment

Sub-theme 1 - Deaf Learning. Participants described that learners are being placed in school without any prior learning of language at a late age, this can affect the development of speech, language, and cognitive skills [1], as well as put pressure on the school, inherent in this, is a perception people may have towards the Deaf further described in the theme of Social Environment - Exclusion. Participants describe incidental learning as a

critical issue for Deaf learning, if the learner is in an environment with little to no social engagement then there are no opportunities for learning as described by Lev Vygotsky's Theory of Social Learning [29]. Posters and QR codes are described as encouraging incidental learning in a passive approach, and the Reggio Emilia Approach describes a concept of the classroom as the "Third Teacher". However, in context, the classroom refers to teaching materials, there is potential to look at the school's architecture as taking an active role in education [30].

Sub-theme 2 - Visual Access. The importance of visual access for the Deaf community has led to cultural phenomena of a social-communicative nature, circular seating, line of sight, the importance of eye contact and preference towards colour contrasting. This sub-theme is the most described in the literature due to its rather obvious nature. Provisions towards improving visual access are: „U”, circular, shaped desk arrangement [31-34]. Lowering furniture and removing visual obstacles [30, 33, 35], having smaller group circles [35], and controlling peripheral visual access [33, 34, 36], transparent materials in railings, corners, doors, mirrors in corners of hallways or classrooms all to improve visual access. Appropriate window placement and understanding of solar analysis will be vital to the design of spaces within the school and technological control of the lighting. The elements of Access (Inclusive Design) and Light and Colour and Sensory Reach (Deaf Space) act as guiding principles towards understanding and resolving visual access concerns.

As the following aspect of visual access, lighting holds similar characteristics. Whether by natural or artificial lighting, controlling it through passive (strategic window placement/brise soleil) or active (curtains or blinds) means is essential to providing an environment that does not cause eye strain, this can be achieved through high even lighting allows for ease of reading lips and signing [33, 34, 37]. contrasting backgrounds with skin/clothing colour highlight DHH conversations [33, 34]. having the appropriate lighting increases attention and academic engagement [32]. One participant expressed interest in skylights as a possible solution to reducing direct lighting.

Sub-Theme 3 - Additional Challenges. Naturally, in a school, there are many different possible challenges, in a specialist Deaf School particularly that of School A where children with learning disabilities such as autism are enrolled there are additional challenges to consider. Physical disabilities can cause difficulty navigating around the school and in the classrooms, this cannot be planned for except by providing introductory provisions of ramps, automatic doors, all of which are described in SANS 10400. Acoustic challenges are mentioned by the participants in less detail than what is described in the scoping review. However, the principle is the same, noises within and without the classroom can distract DHH learners with cochlear implants. One participant describes the challenges of learners with autism, and in any school, it can be a challenge to accommodate those with additional learning disabilities such as autism, as their needs are particular. Classrooms should be

designed to be flexible as each year will present the teacher with new learners that may have these additional difficulties. However, it is essential to impart a sense of belonging (children's home and the concept of "house") for learners no matter what their challenges may be, and this can place a lot of responsibility and stress on the teacher and the learners, making it more crucial to have in-between spaces as a retreat from stresses.

Sub-Theme 4 - The Effect of Covid-19 on the Learning Environment. This sub-theme is not an aspect that directly relates to this study's objectives and problem; however, the teachers felt strongly enough to discuss how it has upset their routine in the interviews. In itself, disruption to routine is enough to take the possibility of unmitigated disasters seriously, further establishing a need for clearly adaptable spaces in a school. Regarding the teaching of deaf learners, social imbalances were reducing the potential for incidental social learning [29] and physical barriers to learners' education where a vital aspect of sign language is facial expression, which would be covered with a mask during class.

Theme ii- Social Environment

Sub-Theme 5 - Deaf Space. Deaf Space, being primarily an architectural concept, was not understood by the participants and participants often requested the definition. However, by taking it literally, they were able to impart their opinions. Participants view Deaf Space as a signing space and connect socially and historically, congruent with what is described in the literature.

Sub Theme 6 – Exclusion. There is much stigmatisation surrounding the deaf often due to a lack of understanding and interaction with the Deaf community. One participant described her daughter, who feels left out and excluded when among hearing people, due to not being involved in the conversation. This isolation from the language barrier is a leading cause of lack of understanding of the Deaf from the hearing world. Following the challenge of incidental learning, one participant describes the sense of denial and lack of acceptance of hearing parents towards their Deaf children, leading to late identification impacting their child's education where the child was brought up with hearing parents who learned sign they succeed later in life. Additionally, a school must strive to be a home away from home to make up for this sense of rejection and isolation that many deaf learners may feel. A Deaf school has the potential to not only bridge the sense of isolation by surrounding children with others who share the same experiences of life, Deaf Same; the school also has the potential and the responsibility to act as a bridge between the Deaf community and the hearing world through hearing parents.

Sub Theme 7 - The Effect of Covid-19 on the Social Environment. Participants described the various ways in which the Covid-19 pandemic impacted the school's social interactions, which affected the schools' ability to conduct dance classes, outreach programs, and social events such as a yearly concert the Deaf learners present

for other schools. School A had plans to develop additional programs for their learners such as journalism, to facilitate incidental learning which was thwarted by covid.

Theme iii - Functional Environment

Sub Theme 8 – Accommodation. As one of the largest sub-themes, there were many creative ideas and concerns the participants had towards available accommodation for Deaf learners. A participant expressed interest in corners causing corridor collisions, peripheral visual access [33, 34, 36], transparent materials, corners, doors, mirrors in corners of hallways or classrooms to increase visual access. Distance between school buildings was both considered as a problem, and as a good thing, one participant expressed concern of students taking a long time to move from one end of the school to the other while the other participant expressed that it provides an opportunity for the learners to have a “break”. Coupled with in-between spaces providing that visual “break”, long distances or short distances may not make a difference except by lessening opportunities for incidental social interaction during breaks and between lessons. Thermal comfort was mentioned, one of the first aspects to designing any building is making sure it is comfortable, taking the idea of comfort further one participant expressed a desire to have direct access to the garden from the classroom which can provide more opportunities for versatile lesson planning and create a more pleasant space. Many of the participants expressed concerns regarding the size of their classrooms, not only to accommodate more learners in a class but also create an adaptable atmosphere, expressing that every year the number of learners in class changes and the teachers have to rearrange and possibly remove furniture, which can be a waste of valuable time. Teachers for the Deaf need more storage as all their educational resources are visual. By placing learners in circular table arrangements or circular arrangements, you improve the visual engagement; however, this takes up more space in a class. One participant expressed that funding from the government is dependent on how many learners you have in your school, in a Deaf school having a large class similar to a mainstream school where there are 50 learners a class is not an option, which impacts the school's funding, which further impacts staff that can be hired. Participants described concern regarding the boarding facilities, being a residential school, one must make the school feel like a home, the hostels cannot be placed too close to classrooms and staff facilities and need their own space.

Sub-Theme 9 - Development. This sub-theme involved the identification of growth and development for the school. Consultation is essential to the design of a school for the Deaf, and if one does not consult Deaf people then it is not truly a design that is done for Deaf people, a participant expressed that there should be significant consultation. The growth of the school is a topic that came up many times throughout the interviews, and the school is limited in the manner in

which it can grow without funding, it cannot accept new students without adding more teachers and classrooms, both of which are not attainable without more students, which can be prevented by having large enough classrooms to accommodate more Deaf learners. However, there is a limit on how many Deaf learners are based on provisions of visual access and seating arrangements. Participants expressed desires for new facilities, a new library, vocational units, and larger boarding school. Library; having an extensive library is crucial to providing a comfortable environment for learners to engage with content that is not curriculum-based. Vocational unit; learners with cognitive disabilities such as autism will benefit from vocational facilities that help teach skills that with getting them employed when leaving school. Boarding school; similar to expanding classrooms' size to accept more learners, the boarding facilities should grow as the school grows. Due to the lack of availability of Deaf schools, many learners come from very far away and cannot drive that distance every day.

Sub Theme 10 – Maintenance. Getting funding for a school can be a challenge. School A is an old school with buildings that require constant maintenance; as such, the funding is going towards conservation instead of new facilities for learners.

Sub Theme 11 - The Effect of Covid-19 on Functionality. Participants described that Covid affected the school's general functionality, impacting access and preventing planning, funding, and future development.

Theme iv - Engagement with Environment

Sub Theme 12 - Pride and Ownership. This sub-theme was created to express the positive expressions that participants had towards School A, and participants expressed pride in their school hall and the multiple uses it has towards benefiting the school and the learners. Participants felt privileged to be in a school with lots of outdoor space and fields, and smaller classes with fewer students, where the ratio of teacher to student is more suitable for in-depth interaction.

7. Conclusion

Our study was conducted during a period where interaction was heavily controlled (social distancing of Covid-19); this is further described in the limitations. However, the challenges it presented were often sources of stress. Also, despite the participants' responses being rich, it was apparent that architecture is not something that the participants understand in detail. Naturally, this comes as no shock as they are teachers, not architects. However, the more one understands architecture, the more opportunities one has to adjust spaces around themselves. Teachers will find it helpful to learn further the various layouts and spatial arrangements that can optimise space.

An initial review of the literature shows little focus on architecture within Deaf schools and the associated needs of this sector of the Deaf population within

primary and secondary education. Beyond the need for an increase in Deaf schools to cater to the Deaf population, there is also an imperative to implement Deaf friendly design into existing specialist schools, as they also lack architecturally responsive spaces for the needs of their Deaf learners [12].

The literature review and participant responses confirm that there is a lack of Deaf friendly spaces in schools with varying levels teachers will do what is in their power to improve classroom spaces however without construction and alteration there is only so much to be done. Therefore, there is a need to implement Deaf friendly design in the construction from stage one, consulting the teachers Deaf and hearing where possible.

Research Question: How can the nature of „Deaf-Space” and „Deafness” influence the architecture of a school for the Deaf?

Conclusion: Deafness and Deaf Space are significant aspects of a school's architecture for the Deaf.

8. Limitations

The researcher is an integral aspect of the study and accepts that there may be some subjectivity in data-analysis as the study subject is known to the researcher. Attempts were made to establish academic rigour and maintain truthfulness to minimize bias. This study has limited generalizability due to a single site being used. This study site is in a School for the Deaf located in one of the nine provinces in South Africa and only involved one school. Therefore, these findings are contextual, are specific to the school understudy and cannot be generalized. Limitations of this study include the restrictions placed due to Covid-19 on physical data collection. The National Department of Basic Education database is flawed and missing much information to help establish an understanding of schools' current accommodation for the DHH. The language barrier, resolved by the interpreter, was a source of stress as the researcher could not be sure about the interpretation's inflexion. Ideally, one should discuss in-depth questions with the interpreter before finalizing. The remote engagement was challenging with poor signal connection while utilizing member checks to ensure accuracy of transcription resolves this.

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