Assistive technologies as an ODeL strategy in promoting support for students with disabilities

Citation: Ditlhale, Tumelo W. and Johnson, Lineo R. 'Assistive Technologies as an ODeL Strategy in Promoting Support for Students with Disabilities'. 1 Jan. 2022 : 1 – 11.

Article type: Research Article

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Abstract: BACKGROUND: Students studying in the higher education system face multiple challenges, such as meeting the minimum requirements for enrolling in a programme, securing tuition fees and adapting to new teaching and learning styles, whilst also coping with minimal support. The challenges are more profound for students with disabilities (SWDs) who must progress and emerge triumphantly as graduates, despite their unique and special needs. OBJECTIVE: By relating the personal experiences of SWDs, this article examines the different types of support they need as they commence their studies in higher education institutions, as well as throughout their journeys. METHODS: The study adopted a qualitative multiple case study research design in which the approaches of public and private high schools in handling SWDs were compared with the experiences of SWDs at a higher education open distance e-learning institution. RESULTS: The findings revealed that the use and availability of assistive technology devices were more pronounced at the school level than at the ODeL institution. The SWDs expressed their frustrations and reported more struggles with their studies at the ODeL institution than they had experienced at school level. CONCLUSION: The SWDs in the study provided some potential improvements that could be implemented by ODeL institutions in addressing their needs and in providing support, whilst also emulating the best practices implemented at high school level.
Keywords: Students-with-disabilities (SWDs), technology assistive devices, high school support, open distance e-learning institution, special learning needs
DOI: 10.3233/TAD-220376

Journal: Technology and Disability, vol. Pre-press, no. Pre-press, pp. 1-11, 2022
Received 15 February 2022
|
Accepted 3 June 2022
|
Published: 27 June 2022

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OBJECTIVE:

By relating the personal experiences of SWDs, this article examines the different types of support they need as they commence their studies in higher education institutions, as well as throughout their journeys.

METHODS:

The study adopted a qualitative multiple case study research design in which the approaches of public and private high schools in handling SWDs were compared with the experiences of SWDs at a higher education open distance e-learning institution.

RESULTS:

The findings revealed that the use and availability of assistive technology devices were more pronounced at the school level than at the ODeL institution. The SWDs expressed their frustrations and reported more struggles with their studies at the ODeL institution than they had experienced at school level.

CONCLUSION:

The SWDs in the study provided some potential improvements that could be implemented by ODeL institutions in addressing their needs and in providing support, whilst also emulating the best practices implemented at high school level.

1.Introduction and overview

People graduating from higher education institutions, whether they have studied on-campus or via Open Distance eLearning (ODeL) can participate in and contribute positively to the political, social and economic forums in their immediate environments. ODeL is a form of delivery of tuition for students that takes place outside the normal lecture halls [1]. It is a new form of distance education characterised by distance education pedagogies, open learning philosophy and eLearning technologies [2]. In the context of this study, ODeL should be seen as providing facilities and resources for learning of students with disabilities (SWDs) so that they can take advantage of the same opportunities as abled students [3].

Successfully progressing through the higher education system is not easy as there are challenges such as meeting the minimum requirements for enrolling in a programme, securing tuition fees, adapting to new teaching and learning styles and coping with a lack of support. It is even more challenging for SWDs to progress through the higher education system without support and to emerge triumphantly as graduates. Lack of support for students, especially those with disabilities, poses the most significant challenge and needs to be addressed. “Culminating in the current thinking around disability, some practices and non-actions in higher education perpetuate injustices towards disabled students …” [4]. Supportive technologies used in ODeL environments should reduce the challenge and make learning materials instantly accessible to students [5]. Provision of such technologies is one way of providing support in an ODeL institution such as the University of South Africa (Unisa), and in the Disability Unit (DU) of such an institution, facilitating a more positive learning experience and increased success. The transition of SWDs from high school into a tertiary education environment puts this phenomenon under the spotlight. This is particularly so as the available literature either talks about ODeL without mentioning assistive technologies or about assistive technologies and learners in other contexts and situations. For example, the use of AT with 28 dyslexic and dysorthographic students aged 12 to 13 was explored at a high school level [6], but not in an ODeL setting. Richardson’s series of writings on ODeL in the European context reflects this problem [7, 8].

Students with disabilities (SWDs) is a phrase used to describe people who have long-term physical, mental, intellectual or sensory impairments [9], which, in interaction with other barriers, may hinder their full and effective participation in society on an equal basis with others [10]. Qualifying SWDs have the right to have access to higher education. The Foundation of Tertiary Institutions of the Northern Metropolis (FOTIM), in a project investigating the functioning of Disability Support Services Units at South African tertiary institutions, reports that more tertiary institutions are beginning to focus on the mainstreaming and inclusion of SWD [11]. However, the report notes with concern that the South African society and tertiary sector “is not yet ready for total faculty integration, although that would be the final aim, and is indeed still in transition”. Not much has changed. Although there has been an increase in the number of SWDs entering higher education due to the inclusive disability legislation, barriers to the full participation of SWDs persist [12]. Disability Units at tertiary institutions in South Africa “thus have an important role to play in ensuring the inclusion and mainstreaming of SWDs within the sector and achieving the desired integrated approach” [13]. Generally, students can access higher education via two modes: campus-based and distance education. However, the distance education mode appears to be favoured, with many SWDs opting for distance education to avoid the problems of access posed by campus-based institutions [7].

Transitioning from one system to the other, such as from the high school education system into the ODeL system or any other institution of higher learning will always require adjustment. Students transitioning from high school into the ODeL system such as that of Unisa need to adjust and be prepared for something quite different because ODeL institutions offer education remotely. Access to online learning has allowed SWDs to access quality education and learn without the restrictive physical limitations generally found on the campuses of HE institutions [14]. Because SWDs are able to access online and distance education through the use of mobile and web-based technologies, this study focuses on ODeL. The difference between residential and ODeL institutions is that residential institutions offer courses in “a classroom setting with a professor giving a lecture and students listening and writing notes – ‘sage on the stage”’ [15] while this face-to-face interaction is not available in ODeL institutions.

For SWDs to ensure that their studies progress well within the ODeL institution, they must have access to technological tools. “Research data suggest that persons with disabilities who use technology in education have greater success in secondary and post-secondary education” [16]. It should be noted that distance education or online learning in the twenty-first century and the Fourth Industrial Revolution (4IR) are driven by technology. “This is especially true as technology rapidly advances and more individuals with disabilities avail themselves to technology-mediated and distance education opportunities” [17].

Maximising support for learners with disabilities would mean that an understanding of different types of assistive technologies, as well as disabilities, would be necessary – but also how to match these technologies with the disabilities concerned and be able to identify how they can be used to support SWDs. Essentially, assistive technologies need to be made available and accessible to those in need of them. The following table is a compilation of insights on assistive devices for SWDs from the Eunice Kennedy Shriver National Institute of Health and Human Development [18].

Table 1

Assistive devices for SWDs [18]

Types of disabilities	Types of assistive technologies	Description and relevance
Vision – different levels of blindness and visual impairment	Magnifiers, talking devices, braille displays, screen reading software, text to speech systems, large print materials and adaptable phones.	Tools are meant to help blind or visually impaired students to be able to access, consume, and understand content in their respective lines of study. Doing practical activities and/or assessments that can be done orally.
Hearing – deaf or completely deaf	Closed captions, personal amplification systems, vibrating devices such as mobile phones with captioning, texting and specialised applications.	Hearing aids help students "connect" with others in an online learning environment. For example, online discussions where mobile phones can alert students and where, with captioning, they can engage with others.
Speech communication	Voice amplification systems, speech output software and speech-generating devices.	Fortunately, in the ODeL environment, students with speech impairments can communicate in writing. The examinations are done mainly in writing. Students can also write emails to communicate with ODeL personnel, such as administrative staff.
Learning, cognition and development	Memory aids, reminder systems, note-taking systems, and audiobooks.	This category needs to be considered very carefully as it relates directly to teaching and learning. Aids, such as computers, computer applications and other assistive devices must be available for the practical support of SWDs. For example, a student who struggles to use printed material might have the choice to use an audiobook as an alternative.
Mobility, seating and positioning	Wheelchairs, walkers, scooters, crutches, automatic page-turners, book-holders and adapted pencil holders.	Mobility aid tools help students be mobile and access places such as exam centres. When at home studying, tools such as automatic page-turners and book-holders can help SWDs in their educational journey.

The above list is not exhaustive as other types of disabilities require different assistive technologies. Types of disabilities also include those involving motor skills, functional limitations, inability to adapt

to the environment and inability to use transportation. These disabilities have their respective matching assistive technologies, such as adaptive switches, book stands, lifts and hand controls. Elements, when matched, can help SWDs when at home and when they want to access the actual university campus, its regional centres and examination centres. As highlighted in this article, assistive technologies are essential elements that help SWDs access education and, when aligned with relevant theories, they ought to provide quality education to SWDs.

In exploring the effectiveness of support for SWDs in the ODeL institution that formed the focus of this study, theories that allow SWDs to construct knowledge and connect with the institution were selected for the study. The two theories, constructivism and connectivism, focus on student-centredness. They are regarded as necessary because teaching and learning are for and about students and their support. Theoretical frameworks offer credibility, deepen the essence and guide the path of a piece of research [19].

As a learning theory, constructivism frames this study with the assumption that SWDs at both the high school and the ODeL institution have to construct knowledge and acquire and develop skills in their interactions with different sources and be supported in many ways. In the construction of skills and knowledge, “the ideas may come from many different sources such as staff development, other teachers, research and practice articles and reflection on experience” [8]. Other sources may include their interactions and collaborations with other student peers, the DU and other units within the institution, such as the Writing Centre and others, which ought to offer services and support to SWDs. Connectivism was developed as a theory by Siemens (2005) and developed further by Downes (2010) to understand learning in the digital age. Connectivism as another theory was selected to underpin this study with the notion that SWDs in the ODeL environment must connect to the networks where information is located and, in this way, receive support. This is to say that, in connectivism, behind the networked system, there are people to provide support to SWDs and because “a network comprises connections between entities (nodes), where the nodes can be individuals, groups, systems, fields, ideas, resources or communities” [20]. Connectivism is a development of constructivism. In this way, both constructivism and connectivism are most suitable to guide this study because interacting or connecting with people, whether face-to-face or virtually, enables students to get both knowledge and support [21, 22, 23].

This article aimed to examine the transition from the high school environment and support offered to SWDs throughout their studies at the ODeL institution concerned. The study aimed to explore assistive technologies that match and support the needs of SWDs in both settings (i.e., the high school and the university) and to further investigate the opportunities and gaps in each. The findings from the study could lead to a deeper understanding of the state of the art in the area and further understanding of the scope and value of the study in enriching learning for SWDs.

2.Research questions

Based on the background of the study, the research question was anchored in determining how SWDs are supported at two high schools specifically for SWDs, traditionally known as the “special schools” in two provinces of Gauteng and North West, and towards their transition to higher education institution in general, but particularly in those offering open distance eLearning such as at Unisa, the biggest ODeL institution in South Africa.

The following sub-questions were formulated to address the central question as follows:

- **1.** What are the different assistive technologies that match and support SWDs’ needs?
- **2.** What resources are available in high schools and ODeL environments to support SWD requirements?
- **3.** What is the role of the Unisa ODeL Disability Unit in supporting the SWD needs?

3.Qualitative research methodology

The qualitative research approach was used in this study to directly learn from participants. The qualitative research approach provides a space where an individual interacts with and observes the participants in the natural environment and comprehends this process's cultural and social contexts [24]. The participants' ideas, feelings, actions and beliefs are considered in their natural settings [25]. This study followed the qualitative approach to collect data about people's emotions and opinions so that meaningful perceptions could be established and expressed. A qualitative approach allowed the researchers to consider the participants' different perspectives on a particular subset of the learners they serve – the SWDs – and was deemed suitable in this instance. A qualitative case study affords the researcher an opportunity to capture living experiences that reflect the participants' reality [26]. Therefore, this study used a case study design to explore the concept of support for SWDs in transitioning from high school into an institution of higher learning such as Unisa. High school teachers teaching SWDs and Unisa staff members from the DU were selected as units of analyses. This allowed the researcher to gain insights into the support provided to SWDs in the ODeL environment. To involve participants in the qualitative case research also meant the case study design focused on and engaged with them in an authentic manner in the context of a real-life problem [27].

3.1Selection of participants and data collection

The sampling method in qualitative research can be done in different ways. In this study, the choice was purposive sampling, which is "the selection of participants or sources of data [was] used in a study, based on their anticipated richness and relevance of the information to the study's research question" [28]. The participants were teachers selected from two high schools in two provinces of Gauteng and North West. The six high school teachers participated in the study as they were purposively selected for their information-rich experience, because they taught learners with disabilities. Other participants were three staff members of the DU at Unisa. The total number of participants was nine. Participants 1 and 2 were from a private school in Gauteng and were females aged 28 and 35 years respectively. Participants 3, 4, 5 and 6 were two males and two females from a public school in North West Province, with teaching experience of between 10 and 40 years. The six teachers in high schools were meant to provide information about those learners anticipating that they would study further after high school. Participants 7, 8 and 9 provided information about the available resources at the DU at Unisa (as the ODeL institution in this article) on how SWDs are supported. There were two females and one male, all above 40 years of age and with more than 10 years' experience collectively.

3.2Thematic analysis from interviews

Data were collected using a semi-structured interview guide prepared beforehand. Semi-structured interviews allowed for a flexible approach that allows participants to elaborate on information that can be of value to researchers [29]. Before the interviews were conducted, a letter was sent to the identified participants inviting them to participate in the interviews and requesting their consent in this regard. Data were collected by the two researchers until saturation point was reached after 12 days of fieldwork with the participants. Saturation point was reached when data became repetitive and did not yield any newer information from the participants. During and after data collection, interviews were recorded, and the audios were transcribed by the researchers, by sharing the recordings amongst themselves. After transcription, triangulation and thematic data analysis were used to code and identify themes and produce the report of the findings.

3.3Document and thematic analyses

In a qualitative study, "document analysis is a systematic procedure for reviewing or evaluating documents – both printed and electronic materials" [30]. The inclusion of documents provides additional rich data and further supports the research outcomes [31]. Organisations and companies, including teaching and learning institutions, found at regional, national and international levels, have policies in place guiding their operations. When policies are in place, they help organisations and companies or people within those institutions to be compliant and to be able to deal with challenges

more effectively. When policies are not in place, teaching and learning institutions may fail to provide the educational needs of students due to the lack of structure and function [32]. A policy can be described as “a plan of action agreed to by a group of people with the power to carry it out and enforce it” [33]. Some policies were considered for the practical support of SWD in the ODeL environment, such as at Unisa and as used in the study. Other documents were also used for the study.

The data gathered from documents and interviews were analysed separately because of the diverse nature thereof. Data gathered from the interviews were analysed first, followed by the analysis of data gathered from documents. The thematic analysis of data was aimed at identifying codes and themes relating to and supporting the research questions. Therefore, thematic analysis was considered a suitable method for analysing the collected data. Policies such as the Strategic Policy Framework on Disability for the Post-Secondary Education and Training System, Unisa’s Open Distance Learning Policy, Tuition Policy and Admission Policy were considered. Both the Unisa Library and staff members from the DU at Unisa were contacted, and the Unisa website was accessed for relevant documents.

Thematic analysis is “a method for identifying, analysing and reporting patterns within data” [34]. A six-step process, as suggested for interpreting and analysing data, was conducted and summarised as:

- **i.** Familiarising oneself with the data; the researchers immersed themselves with the data by looking for repeated patterns, phrases and identifying matching ideas. This was done in relation to how the data related to AT and ODeL and responded to research questions. Familiarisation of data also applied with the transcribed data from verbal responses.
- **ii.** Identifying and generating preliminary codes; generated preliminary codes are derived from ideas, phrases and patterns from familiarisation stage. The researchers were able to identify codes from ideas and shared them to check if one found some that another could not find or identify. Each have their individual lists of codes, some converging/similar and others divergent/different.
- **iii.** Searching for themes; Two lists of codes from the two researchers were then merged to develop a list of themes.
- **iv.** Reviewing themes generate the working list and observed the frequencies in their appearances from the data, until an agreeable list of codes was adopted by the two researchers as overarching and sub-themes, depending largely on the number of their frequencies from the data.
- **v.** Defining and naming themes; researchers then started looking for narratives and verbatim accounts to check if there is any data that match certain themes. Both researchers came up with own verbatim data and explained how they relate with the themes/sub-themes. The stage was instrumental in ensuring that all data was covered and exhaustively used for all themes. The process was able to finally settle for three main themes used in the article, and that relate and respond to the research questions, as outlined in the table 2 below.
- **vi.** Producing and writing the report [34]. The researchers wrote the report based on the three identified and selected themes and ensured that the report covered all main issues of the study, as guided by the research questions. In the end, one researcher was able to consolidate two versions which later gave rise to this article.

Table 2

Research themes and sub-themes

Themes	Sub-themes
1. Different assistive technologies that match and support the needs of SWDs.	a. Different disabilities.
	b. Different assistive technologies.
2. The resources that learners with disabilities use at school.	a. Support structures to teach learners with disabilities.

Themes	Sub-themes
3. Transitioning.	a. Preparation of learners who are about to leave school.

3.4Reliability/trustworthiness checks

This study adopted various strategies for "trustworthiness" such as being able to account for personal biases, record-keeping, which means, demonstrating a clear decision trail and establishing a comparison case. The concept of trustworthiness includes the criteria of credibility, transferability, dependability, and confirmability and that this is different from a quantitative evaluation that has parallel criteria of validity and reliability [35].

Credibility is "the confidence that can be placed in the truth of the research findings" [36] to establish if plausible information from participants and their views are correctly represented. In the semi-structured interviews, the researchers applied this method by asking open-ended questions and not leading participants during the interview process.

Dependability – This was a qualitative study and therefore, reliability would be different from techniques that positivism employ [37]. Dependability cannot be the same or definite all the time because this study dealt with the views of high school teachers teaching SWD and of staff members at Unisa. However, the experiences and views of participants and how they were related were deemed authentic and accurate. The selection of participants and settings for interviews had to be maintained in a logical and stable manner by the researchers and the processes of this research were documented and can be traced. In this regard, a process that is traceable, logical and well documented, ensures that dependability is achieved [38].

Transferability refers to the ability to transfer qualitative research results to other settings or contexts with other participants [36]. Document analysis and data from the participants' interviews were described. It is understandable that the research findings cannot necessarily be transferred to a population that is wider because "the researcher/s cannot know the sites that may wish to transfer the findings" [35].

Confirmability is when other researchers can confirm research findings and establish if these findings arise clearly from the data and are not figments of the researchers' imagination [36]. In the context of this study, a data trail was used and maintained to confirm where data came from (interviews and documents). In summary, the researchers adhered to the four principles in ensuring trustworthiness in this qualitative study was maintained.

4.Findings and discussion

Interviews were conducted with six teacher participants to explore their views on and experiences of support for learners with disabilities at high school in preparation for their tertiary level studies. Three DU staff members from Unisa were also interviewed as regards the support that they offer students in their transition to the new higher education institution (HEI) environment. The research themes and sub-themes used, as identified and generated from the research questions, are tabulated above.

4.1Different disabilities and assistive technologies in support of the SWDs

The first question aimed to understand different assistive technologies that match and support the needs of learners with different disabilities. The private school that was visited specialises in and caters for learners with multiple disabilities, such as emotional barriers, blindness, autism, speech delay, sensory issues, and attention deficit and hyperactivity disorder. Teachers were asked how they perceived their roles and responsibilities in the school to support various disabilities. One teacher from the private school had this to say:

The school's inclusive model means we take students who do not necessarily fit in the mainstream and are not necessarily candidates for remedial school as the South African education system provides. The school incorporates the SWDs to work together according to

their level and transition at their time. We have a whole range of multiple disabilities, except for physical disabilities. Due to available infrastructure, the school focuses on these other disabilities and not physical ones. Thus, our students are physically able; can take care of themselves in terms of mobility and movement. However, most have academic barriers and challenges.

On a similar question directed at the public school that accommodates learners with physical disabilities, one teacher participant was quick to qualify that physical disabilities may include the deaf. However, since they did not teach sign language, the deaf learners were excluded from their school. *"In this school, we have different disabilities and syndromes that were catered for, including the life-threatening to just normal learning disabilities",* one public school teacher revealed. However, she was also quick to note that, due to limited resources, not all disabilities are handled and served as should be the case.

Support for learners with disabilities often needs assistive technology support. Assistive technologies are services and devices used to improve, maintain and increase SWD capabilities [39]. Assistive technologies do not eliminate or curb learning difficulties but can help learners reach their potential, bypass areas of difficulty and capitalise on their strengths [40]. On assistive technologies available at the schools and how they are used, a participant-teacher from a public school said,
"In Grade 12, there was a learner who could not write, and there was a device used to assist in capturing the audio to convert it into writing."

Another teacher from the same school added:
"We have a technological device; everything one does on it projects on the screen to do their experiments. We try to help everyone with everything. Some learners have hearing devices in classes."

In some instances, the assistive devices are customised to address each disability. In such cases, learners are able to take the assistive devices home after school – for example, hearing aids.

Assistive technologies are services and devices used to improve, maintain and increase capabilities of SWDs [39]. Assistive technologies do not eliminate or curb learning difficulties but can help learners reach their potential, bypass areas of difficulty and capitalise on their strengths [40].

From the empirical investigation, it became clear that there are different kinds of assistive technologies being used in schools to support learners with disabilities. According to the four participants that were interviewed, the assistive technologies range from slant boards, coloured writing papers, braille, applications, tablets, laptops, computers, projectors, recorders, interactive boards, internet, learners' cell phones, adapted keyboards, mouse that one can use with a foot, yellow backgrounds, wheel chairs, crutches, and others. Disabilities fall into different categories such as vision, hearing, speech communication, learning, cognition and development, and mobility, seating and positioning [18]. These types of disabilities are catered for by the use of types of assistive technologies found at the two schools as identified and confirmed during the interviews.

4.2Resources for learners and teaching support structures

Learners with disabilities in their learning processes are supported through assistive technologies and resources to ensure that their learning becomes productive and meaningful. There are various resources for both learners and teachers, and these are needed as the support structure to teach learners with disabilities.

At the two schools visited, resources found to support learners with disabilities included an adjusted curriculum; small class sizes; specialised personnel, including teachers, tutors, psychologists, therapists, parents, nurses, social workers; textbooks; boarding facilities; transportation; bursaries; financial cover; extra classes, including one-on-one sessions; internet for learners; devices such as computers, cell phones and the assistive technologies already discussed. At both schools, assistive

technologies were readily available. One participant mentioned that if there was a learner in need of special assistive technology, the school usually tries to find it for that learner.

One participant from a public school said,
"Our resources and support structures include physiotherapists who visit the school, at least once a week or a month or whenever we pick up that there is a problem with a learner. For example, physiotherapists are usually called in to assist in the case of physical disabilities whenever learners need that specialised support that teachers cannot handle."

Teachers are rotated to allow learners to experience the best that each teacher has to offer, and this practice is beneficial as teachers are given a chance to deliver content and express their creativity in supporting the learners. It also means that teachers need to know the barriers a specific learner has and should be able to develop a solution to assist such a learner.

Student support plays an integral role in students' success in learning institutions (both at high school and tertiary level). Student support refers to the phenomenon where services and support to students in their studies. With an increasing number of students from diverse backgrounds, support includes services such as the academic and personal development of students [41]. The student throughput depends on the effectiveness of the support mechanisms put in place by different ODeL institutions. Having student support programmes in place can reduce attrition rates and increase throughput and retention rates [42, 43]. Support is about caring for the students – an expression linked to the principle of ubuntu/botho, a concept of respect to guiding student support. Similarly, education, in the spirit of ubuntu/botho, "involves active participation of the citizens in managing themselves in society and ensuring that everyone is supported" [44]. Just as with the connectivism approach, ubuntu/botho is in keeping with a student-centred approach, with support, and with the spirit of caring.

For its success and that of the students, any institution of teaching and learning needs support staff in place. Human services include academics, administration, support and others. These staff members are there to help, administer, direct and solve any issues relating to the business of teaching and learning. They have to offer their services to all within the institution, especially the students. For the system to be sustainable, distance education services available through ICT processes should support all stakeholders, particularly distance learners in the higher education system [45]. Among other things, staff in the higher education system are responsible for providing information about different things, including information about funding, to those in need of it. To succeed, SWDs enrolled in distance education must have access to people who can help and support them. Accessing online facilities, such as the library and Writing Centre, as well as university staff, and study material, is essential for SWDs, as it is for all other students enrolled in distance education [46]. It is advantageous to embrace and use Open Access and Open Educational Resources (OERs) such as teaching, learning, research, lab, games and simulations, materials, as well as many others, as they are free to be used and can be accessed by anyone from anywhere in the world. OERs and Open Access also include having access to human services online.

4.3Transitioning from high school to tertiary institutions

The preparation of learners for their post-secondary journey is more important than ever before because we live in a digital age in which technology is becoming increasingly dominant in people's lives. Learners who are about to leave school need to be prepared for the constant changes in their lives as technology continues to develop. During the interviews with the high school teachers, the participants concluded that their schools exposed their learners to different career paths. One participant from the private school said,
"Since most if not all learners own mobile phones, we teach and encourage them to use them for their learning purposes, such as conducting a search using Google or other search engines. Good writing skills can also be learnt using search engines on mobile phones" I make sure learners complete all their forms for university applications … we also take them to career

expositions; we have a career expo for disabilities – where we take them for registration at the universities and help them as far as we can."

One participant from the public high school said,
"We have a system where we keep contact details of admission offices in various higher education institutions that accept our SWDs, and where our learners are continuing their studies. We continue to monitor the progress they are making as they transition into these institutions, and for future reference."

Another teacher, from the private school, said:
"We encourage our learners to call us whenever they need assistance and support that we can offer them. That is despite being in this new environment. For the time being, when they are still new and not yet on their feet, they call us, and we can learn and link them with the right people there, where we can. In that way, we also get to learn their challenges better to prepare for the upcoming ones later."

The three participants from the Unisa DU were interviewed in order to gain an understanding of their experiences and the different roles they played in supporting SWDs within the ODeL institution. Staff members and the DU represent the university in supporting SWDs in their transition from high school. Institutions of higher learning in South Africa are not special needs institutions and, therefore, operate differently from special needs schools. They admit and enrol students with different disabilities and needs and who must be supported in their studies in order for them to exit the system as successful graduates. In this regard, this theme addressed the first research question, and two sub-themes emerged: different disabilities and different assistive technologies and transitional support structures offered by the university.

The number of students enrolled in the 26 public universities in South Africa was 9 040 in 2018 [47]. According to Participants 7, 8 and 9 of this study, the DU of the Unisa ODeL assists and supports at least 3 000 SWD annually, on average, translating to about 33% of the total enrolments of SWDs nationally This is more SWDs than any other public institution of higher learning in the country. Participants 7, 8 and 9 mentioned that they cater for different disabilities related to vision, hearing, mental impairments, intellectual disability, autism, physical disabilities and others. Participants 7 and 8 also mentioned that they had students with "*all kinds of disabilities*", while Participant 9 said,
"We have students who are deaf, hard of hearing, blind, partially sighted, paraplegic, have learning disabilities, schizophrenic, bipolar, and have autism, to name a few."

He further stated that the role of a DU at the ODeL institution in accommodating students with diverse kinds of disabilities was helping and supporting SWDs with their various academic, emotional and psychological needs. That, he said, can be achieved if support is structured and done well, when there are matching assistive technologies, and when the DU itself receives support from the university at large. Unlike learners with disabilities who have access to resources and assistive technologies within their school premises, SWDs at the ODeL institution do not have immediate access to resources and assistive technologies because many students are geographically removed from the campus. It is especially true of those students located in remote areas. Unless they travel to the regional areas for help and support or have the resources at their homes, they cannot access the resources and assistive technologies. Assistive technologies at the ODeL institution were regarded as insufficient to cater for SWDs' needs with availability being less than 50%. It becomes a problem for many students because they cannot access the main campus or regional centres where these facilities are mainly located. The views of participants 3, 4, 5 and 6 are in line with as expressed that "few students with disabilities progress to higher education … due to unavoidable barriers they face as they navigate different educational structures from lower levels" [4]. Learners transition from one system and level of education to another, such as from the high school education system into the ODeL system, or into any other institution of higher learning, and thus require a degree of adjustment. For example, students transitioning from high school into the ODeL system, such as in the case of Unisa, need to adjust and be prepared for something entirely different because ODeL

institutions offer education remotely. Unisa strives in being “open” to accommodating different individuals from different backgrounds, including SWDs and those furthering studies from high school to tertiary level. Indeed, Unisa has become more accessible since it added eLearning to its mix, but without yet doing away with printed materials. With the blended delivery mode, Unisa did not impose restrictions on students who did not have internet access. Moving towards eLearning opened up opportunities to use more methods and technologies and to apply theories such as constructivism and connectivism – theories anchoring this article.

Distance education was a model in which individuals pursued their studies using postal communications between them and their teachers [48]. With rapid developments and the emergence of new technologies, and the demands of the 4IR such as mass media, teleconferencing, computer conferencing and database-assisted learning, individuals currently pursue their studies via technology platforms. Distance education is a flexible mode to provide education. The flexibility that it offers is one of the main reasons why so many people use it, including SWD. UNISA is the largest university offering distance education in South Africa and has adopted the ODeL model. ODeL is a form of distance education with a subset of eLearning that is “facilitated by the use of computers, using the internet, an institution’s intranet, or material on disks” [49]. Distance education is not only flexible but also provides access to higher education for the masses that were previously marginalised in South Africa and this includes SWD. “Distance-teaching universities are able to enrol large numbers of students at a lower cost and, as such, contribute greatly to the broadening of access to higher education and to social equity” [50].

5.Conclusion

The purpose of this study was to determine the level of support provided for SWDs at the two high schools, one public and another private. The two high schools are classified as special education centres catering specifically for SWDs, and the University of South Africa, the biggest ODeL institution in South Africa. The study was able to establish the different assistive technologies that match and support SWD needs in the high school and at tertiary levels. Additionally, the available resources in high schools and ODeL environments to support SWD requirements were unravelled. Lastly, the study established that at Unisa the role and presence of the DU in supporting the needs and requirements of the SWDs are limited. The useful technological assistive devices as an important component and service needed by SWDs were found to be lacking.

The findings further revealed that the use of technology and availability of assistive devices was more prevalent at the school level than at the ODeL institution. Learners with disabilities at the school level were assisted, according to their specific needs, with technologies and assistive devices more than those at Unisa, the ODeL institution in the study. Additionally, the SWDs could also connect to the networks to construct knowledge according to the connectivist and constructivist theories. Technology continues to have a major impact on teaching and learning where teaching and learning are done online, with online discussions/forums, and through specific devices for SWDs. With policies in place, management at Unisa needs to ensure that SWDs are included and supported as effectively as they are with assistive devices in special education high schools and can readily access online platforms and services. While the presence and support services provided by the DU is acknowledged at Unisa, it is recommended that links and relationships be established between the DUs of higher education institutions and high schools with the sole purpose of maximising support for SWDs.

Author contributions

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REVISION FOR IMPORTANT INTELLECTUAL CONTENT: Lineo Johnson.

SUPERVISION: Lineo Johnson.

Ethical considerations

This study was granted permission by the Unisa Committee on Ethics clearance. All the data, facts, information and interpretation are referred from participants of the study and already published article and journals.

Acknowledgments

This article was made possible by the funding provided by the University of South Africa to study conducted.

Conflict of interest

The authors have no conflicts of interest to report.

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