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Influences on selection of assistive technology for young children in South Africa: Perspectives from rehabilitation professionals

Karin van Niekerk*[1], Shakila Dada[1] & Kerstin Tönsing[1]

*Corresponding author:
e-mail: karin.vanniekerk@up.ac.za
Postal address: Centre for AAC, Communication Pathology Building, University of Pretoria, Hatfield, 0002.

Affiliations:
1 Centre for AAC, University of Pretoria

Adherence to ethical standards

The ethical board of the University of Pretoria approved the study.

Abstract

Selection of assistive technology for young children is a complex process. Within a context with limited resources, such as South Africa, research is needed to determine the factors influencing the assistive technology selection process, as these could ultimately either facilitate or hinder the availability and accessibility of affordable, adaptable, acceptable and high quality assistive technology for this age group.

Method: Two asynchronous online focus groups were conducted with sixteen rehabilitation professionals to identify the factors they perceived to influence the selection and provision of assistive technology to young children within the South African context.

Data analysis: A process of deductive thematic analysis was followed by inductive analysis of the data. Components of the Assistive Technology Device Selection Framework were used as themes to guide the deductive analysis, followed by inductive analysis to create subthemes.

Discussion: The important role of the professional was highlighted in negotiating all the factors to consider in the assistive technology selection and provision process. Adaptation of the assistive technology selection framework is suggested in order to facilitate application to low resourced contexts, such as South Africa.

Keywords: assistive technology; young children; low resourced context; rehabilitation professional; selection, online focus group.

Implications for Rehabilitation

- Assistive technology selection is a complex process with factors pertaining to the users (child and family) of the assistive technology, as well as the rehabilitation professional recommending the assistive technology influencing the process.
- Although it may be an important factor, the availability of financial resources to purchase assistive technology is not the only determining factor in providing

appropriate assistive technology to young children in contexts with limited resources.

- Formalised support, such as reflective supervision or mentorship programmes should be facilitated and utilised by recommending professionals.
- Home and school visits during assessment ensure a good match between assistive technology and users within the particular context.
- Facilitating the availability of assistive technology for trial during assessment and/or for a period afterwards will increase the likelihood that appropriate recommendations for assistive technology are made.

Introduction

Although the benefits of assistive technology (AT) for young children and their families have been well described (1–5), AT continues to be underutilised by this population (6,7). Although several reasons can be proposed for this, the appropriate selection of AT can play an important role. Appropriate selection of AT is believed to have a positive influence on user-satisfaction and could contribute favourably to long term use of AT (8). Furthermore, it has been suggested that appropriate selection can improve the cost effectiveness of AT (8).

With the profound unmet need for rehabilitation (including AT) services in less resourced environments (9), appropriate AT selection becomes particularly important, as limited resources have to be optimised in order to improve and optimise AT service delivery. Endeavours to support and expand AT service provision within resource-limited contexts should aim to address the availability, accessibility, affordability, adaptability, acceptability and quality of AT provided (10,11).

AT selection is a complex process (12) that has been described by several authors. Scherer et al. (13) depicted this in the AT Device Selection Framework. This

framework illustrates that environmental factors (including, for example, cultural and financial priorities, as well as policies and legislation) together with personal factors of the AT user and provider (for example their knowledge and expectations) interact to influence the AT decision-making and selection process. When AT is recommended to young children, family-centred decision making regarding the selection of AT has long been regarded as best practice (14,15). This implies that both the child and family are the users of the AT, and that both should be involved in thoughtfully and purposefully selecting AT that will meet their needs and purposes within their context.

A limited number of empirical studies have looked into the factors that influence the provision/recommendation of AT to children. A recent systematic review aimed specifically at identifying studies focussed on determining factors influencing AT selection or provision to children (16) included only six articles. This review synthesised the factors influencing AT selection for children identified in the articles by categorising these factors based on the AT Device Selection Framework (13). This included aspects pertaining to the environment, the user/s of the AT, the professional involved in recommending the AT, as well as factors pertaining to the AT itself. It is interesting to note that all six articles identified in the systematic review originated from well-resourced settings, including the United States of America, Canada and Australia. Although the factors identified in well resourced environments may likely be very applicable in contexts with limited resources, limited research evidence is available to support this.

It is estimated that only 5 - 15% of people requiring AT within low and middle income countries have access to it (17). One might easily imagine that the availability of financial resources from individual users or governments to acquire devices constitutes the major difference between the less resourced and well resourced contexts. However,

this is a gross simplification of matters, which may lead to, for example, donations of expensive yet inappropriate AT to low resourced environments, without cognisance of, for example, the training, professional support or maintenance required to utilise AT (18). Contextual factors could pervasively influence what AT (if any) is selected and provided to a particular child. Consider, for example, the influence of context on the selection of appropriate AAC (Augmentative and Alternative Communication) technology for a young child who does not have electricity at home, and whose parents may not be literate. The importance of context is reflected in the AT Device Selection framework (13), where context is shown to form the backdrop of all AT selection.

Children within the South African context may be exposed to several risk factors to child development, which may contribute to the high levels of disability within the country. It is estimated that 11.2% of South Africans children may have a disability (19). The quadruple burden of disease (20,21) that affect children in South Africa includes aspects of maternal and neonatal healthcare, the high prevalence of HIV and TB, high levels of trauma and violence (resulting, for example, in stabbings and mental illness) as well as non-communicable diseases (such as stroke and amputation). These aspects may all influence a child's development by directly impacting on the child's own body (such as having cerebral palsy after an injury at birth) or in a more indirect way, by influencing the care giving environment in which they grow up (for example if they are orphaned due to losing both parents to HIV). In addition to these risks, approximately 63% of children in South Africa live in poor households (22). With the link between poverty and disability widely understood (21,23), it is clear that poverty is another risk factor for disability for children in South Africa.

South Africa currently has two systems of healthcare delivery where young children and families typically access AT – the public and the private healthcare system.

Although the possibility exists that children (birth to 6 years) could access AT though the education system, this system focuses mostly on children from approximately 6 years of age (when schooling becomes compulsory). Obtaining AT may also be possible through private funding or non-government organisations.

The public healthcare system provides all citizens access to free primary healthcare within communities. All additional healthcare services are available to all citizens with services billed based on the income of the user. Since 1994, free (comprehensive) healthcare services are provided to all pregnant woman and children under 6 years that access public healthcare services (24). This includes access to certain AT, including communication devices and wheelchairs. AT to facilitate the participation of children with disability is typically selected by an occupational therapist, speech-language therapist (who may or may not be dually qualified in audiology as well), or physiotherapist from a list of available options that are on the National Tender for AT. The National Tender document includes a list of AT options from which therapists employed within the public health sector can make a selection, within the budgetary allowances set by their hospital/clinic.

Although free healthcare services are available to children under 6 years, well resourced families tend to prefer to access the private health care sector, due to the challenges (including, for example limited numbers of health workers providing services in overburdened health facilities) associated with the public health care system (25). These families are typically covered by medical aids (medical insurance). In 2015, 17.5% of the entire population (of 54.4 million people), were covered to a certain extent by a medical aid (26). This percentage was higher in the more affluent provinces of Gauteng (27.7%) and the Western Cape (24.2%), as well as in all metropolitan areas (26.4%), including the capital city of Tswane (previously Pretoria, 33%). Within the

private healthcare sector, rehabilitation professionals, teachers, AT suppliers or parents may select AT that they deem appropriate for use. AT is then ordered from a specific supplier directly. Selected AT may or may not be covered by medical aid benefits, depending on the AT and the specific medical aid option, implying that persons utilising this service are often required to pay for their AT in addition to their medical aid contribution (18).

Although the majority of citizens access the public healthcare service (over 80% of the population of 54.4 million) (26), the majority of healthcare professionals provide services within the private healthcare environment. In an effort to increase the number of healthcare professionals employed in the public sector (particularly in rural areas), all graduating healthcare professionals, including occupational therapists, speech-language therapists (with or without dual qualification in audiology), and physiotherapists have since the early 2000's been required to complete one year of compulsory community service in the public sector after completing their degree training. Although this has led to a marked increase in the numbers of rehabilitation professionals employed in the public sector (24), the distribution remains disproportionate. In 2010, for example, 82.5% of registered physiotherapists and 76.1% of registered occupational therapists provided services in the private health sector, leaving only 17.5% of physiotherapists (1009 therapists) and 23.9% of occupational therapists (838 therapists) employed in the public sector (25), providing services to a population of several million.

Although the numbers of professionals in the public sector have increased, so-called "community-service therapists" are often given the difficult task of providing appropriate AT in under resourced rural areas that may have inadequate infrastructure to provide comprehensive AT services. Newly trained, with limited work experience, this poses a challenging task. To complicate matters further, therapists providing services

are often from different language or cultural groups and economic background than their clients (27).

Furthermore, the South African context is characterised by many families that do not necessarily consist of the nuclear family unit which tends to be more typical in many Western contexts. Many children live in households comprising of extended families, with 86% of South African children living in households with two or more adults (28). Furthermore, it is estimated that 23% of South African children do not live with either of their biological parents (28). Some of these children are orphans, but most (8 out of 10) are cared for by relatives (such as a grandmother), even though they have (at least) one living parent (28). In addition, even when a biological parent does live in the same household, he/she may not be the main caregiver (29). Furthermore, 1711 000 adults within South Africa have reportedly received no formal schooling, with over 5 million adults leaving school at some stage during their primary school education (Grade 7) (26). This has clear implications for the literacy levels of adults, many of whom may be taking care of children. Family-centred AT selection requires the cognisance of these family factors and involving all relevant role players and decision-makers within the (extended) family and possibly also the community (30). From the above discussion, it is clear that there are many factors that may influence and complicate AT selection and provision to young children with disabilities in the South African context.

Therefore, this study aimed to determine the factors perceived by occupational therapists, physiotherapists and speech-language therapists (with or without dual qualification in audiology) to influence the provision/selection of AT to young children in the South African context.

Methods

Design

Ethics approval for the study was obtained from the relevant university. Two asynchronous online focus groups were conducted, each with eight participants. Online focus groups were preferred over face-to-face groups as it was convenient and comfortable for participants (31,32) and provided access to diverse participants (33,34) in diverse geographic locations throughout South Africa.

Asynchronous online focus groups (where participants do not all have to be online at the same time) were selected over synchronous online groups (where participants are online together at the same time for a shorter time period) as these are well suited to participants with limited time (35). Another significant advantage of asynchronous focus groups is that it allows time for reflection on the questions as well as the discussion points, possibly adding to the depth of discussion (33,35).

Participant selection

Participants were required to: i) be qualified as an occupational therapist, physiotherapist or speech-language therapist (with or without dual qualification in audiology); ii) be registered at the Health Professions Council of South Africa; iii) be fluent in English; iv) have at least three years of experience in the recommendation/provision of AT to children between 0 and 6 years of age; and v) have reliable internet access (due to the online focus group method selected).

The researchers employed purposive sampling methods. The researchers attempted to recruit participants from all over the country, with professionals living in large metropolitan areas as well as rural communities invited to participate. Participants working in different contexts, for example both private and public health care settings, as well as educational settings and non-government organisations were invited. This

was done to increase the opinions and diverse perspectives in the group. The first author sent out email invitations to personal and work acquaintances as well as staff members at several universities and requested them to invite/nominate persons that may be eligible to participate in the study by forwarding the information to them. The invitation explained the eligibility criteria and details of the study, as well as an invitation to contact the first author if there was an interest to participate and/or find out more. Sixteen professionals contacted the first author and expressed an interest to participate in the study. They were sent an electronic information letter describing the broader study and procedures for the online focus groups, together with a consent form and a short biographical questionnaire. Sixteen participants submitted the signed consent form, agreeing to participate in the study. They also submitted the biographical questionnaire. Both were submitted electronically to the researcher using Google Forms.

A description of the participants can be viewed in Table 1. The majority of participants (81,3%) had a Masters degree. A large percentage of participants provided services in the provinces of Gauteng (43,8%) and the Western Cape (37,5%) and specially within the metropolitan areas of those provinces.

Table 1. *Demographic details of participants (N=16)*

Demographics	n	Percentage of total
Profession		
Occupational therapist	5	31.25%
Physiotherapist	3	18.75%
Speech-language therapist	4	25%
Speech-language therapist and audiologist	4	25%
Highest qualification		
Bachelors degree	2	12.5%
Masters degree	13	81.25%
Doctoral degree	1	6.25%
Number of years of experience in recommending/providing AT to children birth to 6 years		
3-5 years	5	31.25%
6-10 years	9	56.25%
11-20 years	1	6.25%
21-30 years	1	6.25%
Province of South Africa where service is provided		
Free State	1	6.25%
Gauteng	7	43.75%
Kwazulu Natal	1	6.25%
North West province	1	6.25%
Western Cape	6	37.5%
Area where service is provided		
City	13	81.25%
Non metropolitan areas	2	12.5%
Both	1	6.25%
Current employment setting (could select more than one option)		

Demographics	n	Percentage of total
Private Practice	3	18.75%
Pubic hospital	7	43.75%
Public School	2	12.5%
Non government organisation	3	18.75%
Clinic	1	6.25%
Other	2	12.5%
Setting in which AT was provided/recommended (previously and/or currently) to children birth to 6 years (could select more than one option)		
Private Practice	4	25.00%
Pubic hospital	9	56.25%
Public School	4	25.00%
Non government organisation	3	18.75%
Clinic	1	6.25%
Other	2	12.5%

Procedures

The participants were given the option of two dates for the focus group discussions, with the researcher attempting to include (as far as possible) a diversity of professions in every group. The two focus groups were each conducted over four consecutive days (Wednesday to Saturday). Each group had eight participants, with the first group including two occupational therapists, one physiotherapist, two speech-language therapists and three speech-language therapists and audiologists. The second online focus group included three occupational therapists, two physiotherapists, two speech-language therapists and one speech-language therapist and audiologist. The online focus groups took place within the discussion tool of ClickUP, the online learning system of the University of Pretoria. This system utilises Blackboard Learn ™. In order to access

this system, every participant required a unique login, which provided secure access (only to members of the group as well as researchers) to the discussion. In preparation of the online focus groups, every participant was sent an information sheet explaining how they could gain access to the online forum where the focus group was to be conducted. To ensure that all had access, all participants were given the opportunity to access and respond to an ice breaker practice question on the online forum any time during the 5 days before the onset of each focus group.

A script with word for word instructions and explanations was formulated for use by the researcher for posting during the focus groups. It was used unchanged for both focus groups. This explained that the first author would post two questions on the first day of the focus group, and two questions on the second day. The group discussion remained open for four days. Participants were requested to contribute to questions as often as they were able, preferably answering every question at least once during the four days. Participants were encouraged to share their views and experiences as openly as possible, even if they differed from those of another participant. Furthermore, they were encouraged to respond to each other's contributions and use "emoticons" such as ☺ for happy to communicate their feelings during the focus group. As emotional expression from participants is often lost in the online environment, the use of emoticons can be used to substitute non-verbal and para-verbal communication that may assist in conveying meaning (35,36). The participants were able to enter the discussion and respond to the questions posted by the first author at a time of day that suited them.

The four online focus group questions developed by the authors (provided in Table 2) were reviewed by a panel of eight rehabilitation professionals working in the field of AT before the onset of the groups as recommended by Krueger and Casey (37).

After feedback the questions were adapted and the sequence of the questions was determined.

Table 2. *Online focus group questions*

Question number	Question
1	Could you please introduce yourself, share your profession and explain where you work.
2	Please share with us what types of AT you work with?
3	Please describe the process of how AT is provided/recommended to children birth to 6 years at your current place of work.
4	What do you think are the factors that influence professionals in the provision/recommendation of AT to children birth to six years? Please explain.

Credibility

All participants were ensured at the start of the sessions that there were no right or wrong answers and that they could share their opinions freely. They were also ensured that they could withdraw from the session at any time. During the focus groups, the researcher asked follow up questions within the discussion for instances where a participant's response required further clarification or if added detail would contribute to the discussion. If necessary, probing questions were asked. These included variations of "Any examples to illustrate this?" or "Could you explain that please?". In order to facilitate the involvement of the group, the researcher also asked for responses from the other group members, for example, whether anyone had a similar experience or could relate to the comments made. Participants were able to edit their own contributions during the course of the focus group, enabling them to communicate their messages as clearly as possible.

Furthermore, certain characteristics of the online asynchronous focus group may encourage truthfulness in participants (32). It has been proposed that participants are more likely to be truthful in online communication when using a medium that is

asynchronous (as opposed to synchronous) and that is easily/automatically recorded, as is the case in asynchronous online focus groups (38).

Data analysis

The transcripts of both focus groups were created from the online discussions. All participant names were replaced by numbers. Transcripts were sent out to the all participants that were encouraged to check the correctness and were given the opportunity to clarify any of their statements if they wished to do so. Three participants from each focus group responded to the invitation to check the transcripts. One change was made to the transcript, with a participant wishing to clarify/reword one of her own contributions. The transcripts were entered into qualitative data analysis software Atlas.ti™, which was used to manage the process of data analysis.

A process of deductive(theoretical) thematic analysis, utilising a pre-existing coding framework (39), was followed by inductive analysis of the data to create subthemes based on patterns occurring in the data (39). In the first (deductive) phase, the components of the AT Device Selection Framework (13) were used as themes. The first three themes were derived from the environmental factors specified within the framework. These include (i) cultural and financial priorities, (ii) policies and legislation as well as (iii) attitudes. Four themes were derived from the personal factors pertaining to the provider of the AT as well as the consumer, as specified in the framework. These include (iv) resources, (v) knowledge and information, (vi) expectations and (vii) preferences and priorities. The theme (viii) assessment was an amalgamation of two separate components of the AT Device Selection framework (Assessment of functional AT Device need, as well as Assessment of AT Device predisposition), as these were difficult to separate during analysis. Operational definitions were created for these themes and can be viewed in Table 3. Segments of

Table 3. *Identified themes, subthemes and examples as discussed by participants*

Themes	Subthemes	Instances identified	Examples of issues discussed by participants
Cultural & financial priorities Factors that play a role within a specific culture or financial climate/society. Refers to aspects on a macro level.	General	3	Socioeconomic factors mentioned as barrier to the use of particularly high technology AT.
Policies & legislation Any mention of aspects related to legislation, policy, guidelines, or issues mentioned related to policies or legislation.	Policy	31	National Tender stipulates what AT can be provided.
	Financial provision	14	Medical aids can be requested to contribute to AT costs for private clients.
	Prescription guidelines	7	Often no formal guidelines are followed.
	Red tape	5	Extensive paperwork may be required to enable access to expensive devices.
	Waiting lists	6	Children have to wait so long that they might outgrow the device before they receive it.
	Fragmentation of services	12	Fragmentation e.g. between services when transitioning between hospital-based and school-based services.
	Practice barriers	10	Rural hospitals may not have similar access to AT than hospitals in urban areas.
Attitudes Attitudes of people in the environment, e.g. – family, stakeholders, team members. Attitudes are defined as having three parts- cognitive (thoughts and ideas), behavioural (behaviours/behavioural intentions) and affective (feelings and emotions) (64) regarding AT.	Attitudes of parents/ family/ caregivers	20	Acceptance of disability and acceptance of AT.
	Attitudes of teachers/other professionals	16	Passion to improve the outcomes for children will drive professionals to find solutions.
	Attitude of child	5	Child should see the need for the AT - that creates a positive attitude towards it.
Resources All available resources.	Financial	25	Finances viewed as the most important resource to consider.
	Families	18	Families asked to adapt items themselves, asked to use their current technology to assist their child.

Themes	Subthemes	Instances identified	Examples of issues discussed by participants
Financial resources to pay for/provide AT included e.g., from family, government, medical aid, funders etc.	Professional/paraprofessional support	22	A pre-evaluation questionnaire is filled out prior to an assessment for AAC at specialised clinic by the current service providers knowledgeable about the child and family.
Human resources including support from e.g. family/friends, team members, mentors, technicians, availability of time as resource.	Sustained professional/ paraprofessional support	11	Follow-up sessions are not regular, therefore certain AT sent home with child as soon as possible to ensure that it is available to the family.
	Teamwork between professionals and family	20	Collaboration between families and professionals viewed as a resource.
	Expert/ mentor	7	Booking of joint appointments with experienced (mentor) and inexperienced therapists conducted to increase skill in therapist.
	Time	7	Children typically receive intervention once a month (even when severely disabled). Therefore, limited time to consider AT.
Knowledge & Information All aspects related to knowledge and information regarding AT, pertaining to both the professional and the users (child and family) was identified. Self efficacy refers to a person's (in this case the professional's) belief in their own ability to complete an action successfully in any particular domain (65), in this case their confidence in their own abilities regarding AT selection.	Pertaining to the family/caregivers:		
	- Knowledge	6	Belief in myths around AT could limit interest in AT.
	- Skills & experience	5	Prior experience with AT facilitates the AT provision process.
	- Training	17	Communication boards made and modified after training with parents.
	Pertaining to the professional:		
	- Knowledge	7	Knowledge on high technology AT will determine whether a therapist would recommend it.
	- Experience	10	Inexperienced therapists find the challenges overwhelming.
	- Skill & resourcefulness	32	Experienced therapists able to utilise their creativity to create solutions.
	- Training	4	AT selected often depends on where (which university) a therapist received her training.
	- Self efficacy	3	Confidence in their skills determine whether therapist recommend complex AT independently.
Expectations	Parent/ family/caregiver	5	Parent may have attitude that child should be grateful for what they have received, even if it is not suitable.

Themes	Subthemes	Instances identified	Examples of issues discussed by participants
The child and family (users) as well as professionals bring internal and external expectations to the process. These include for example the expectations of their culture, peers, and society in general(13).	Teachers/other professionals	3	Perceptions from professionals that children are "too" disabled to benefit from a device.
Preferences & Priorities Determined by "prior history with AT Devices, their particular level of motivation, judgment, and outlook, and many other factors that serve to combine in a way defining each of us as unique individuals. These influences include personality and temperament characteristics...[that] serve to determine our preferences and priorities" (3, p.6)	Professional	7	Preferences of nurses considered in selection of AAC for use in medical wards with patient unable to speak.
	Family	3	Family should be given choices and to indicate their preference
	Child	3	Use of parent's cell phone could be considered for AT purposes as children are very motivated to access it.
Assessment Aspects influencing the actual AT assessment included here e.g. the environment where the AT will be used, client characteristics and diagnosis, needs expressed by the family during assessment etc. The assessment theme incorporates two components (assessment of functional AT need and functional AT disposition) of the AT Device Selection Framework (13) .	Assessment approach of provider	13	Family-centered services reported.
	Activity & participation	25	Focus on AT that could facilitate participation in routines.
	Therapy goals	5	AT can be withdrawn as child expands their skill.
	Environment		
	- home/school/ hospital	19	Assessment of physical environment.
	- Community	12	Concerns for safety within the community (high crime rate).
	Child characteristics	31	Assessment of e.g. physical or intellectual abilities.
	Assessment of needs		
	- Family needs	16	Parent interviews used to determine needs of the family.

Themes	Subthemes	Instances identified	Examples of issues discussed by participants
	- Perceived needs of child	10	Perceived need of the child for safety and not getting hurt.
	Goodness of fit	8	Appropriateness of AT considering all factors.
Assistive technology All factors pertaining to the AT itself, e.g. its characteristics and availability.	Availability	43	The AT tender and stock at hospitals determine availability. Therapists use whatever they have available, including low cost items and second hand devices.
	Availability for trial	21	Large public hospitals may have AAC devices available for trial.
	Device characteristics		
	- Appropriateness	7	Cultural appropriateness, particularly pertaining to AAC including language appropriateness of AAC devices.
	- Ease of maintenance	7	Physical location could impact on ease of maintenance.
	- Flexibility/ adaptability	5	AT should be flexible to changing needs. AT should "grow" with the child, e.g. positioning and seating devices.
	- Cost	5	Low cost AT preferred, high cost limits availability of AT.
	- Other device characteristics	10	Portability, acceptable appearance, comfort.
Decision making Descriptions of how AT decision making takes place.	Professional (as only decision maker)	3	Within the acute hospital acute care setting, making decisions about communication board vocabulary without family involvement (families may not be accessible/available).
	Family (as only decision maker)	4	Families asked to make the decision regarding AT selection - participant mentioned that they sometimes do not end up making it.
	Collaborative decision between professional and family	2	Process of AT decision making described as a team effort between the professional and family.

text were allocated to a theme, and occasionally, one segment could have more than one theme allocated to it. A category for (ix)"other" was created, where all data items were placed that did not fit into any of the excising themes. After the first author deductively analysed all the data according to the nine themes, the second author checked the analysis. If disagreement occurred, this was discussed until agreement was reached. Thereafter, the second (inductive) phase of data analysis could begin. During this process, all of the data items that were in the "other" category, where analysed inductively. The theme (x)"AT" was created during this process. Furthermore, the theme (xi)"decision making" was conceptualised as separate from the pre-existing "assessment" theme, although it is presented as part of assessment in the AT Device Selection framework (13). This brought the total number of themes to ten, as the "other" theme was eliminated during this process. Subthemes were created through inductive analysis under all ten themes. Again, the second author checked the analysis done by the first author. Agreement was reached over the new themes and subthemes, as well as analysis of items. After this process, the first author worked through both transcripts again ensuring that all items were coded consistently, also considering the newly created themes. The third author checked the complete analysis. All disagreements were discussed until agreement was reached.

Results

All the themes and subthemes identified are shown in Table 3. Operational definitions of the themes are provided together with an example to illustrate the meaning of every subtheme. Examples from every theme will be discussed.

Cultural and financial priorities

Cultural and financial priorities refer to factors that influence AT selection on a macro

level within a specific society. Financial priorities could include, for example the economic climate in the country at a specific time.

Scherer et al. (12,p.4) specify that cultural priorities refer to "specific patterns of behaviours and values (such as the provision of care) that are shared among members of a designated group and are distinguishable from those of other groups. Culture includes, but is not limited to, geographic origin, language, traditions, values, religion, food preferences, communication, education, and lifestyle". Within the African context this could include, for example the stigmatisation and marginalisation of people with disabilities (40), or beliefs about the etiology of disability (41).

Participants did not discuss the influence of cultural and financial priorities (as conceptualised on a macro/societal level) on their AT selection in depth. A number of participants did mention that the availability of finances was very important to their selections and that limited funds restricted the available AT options. However, most of the contributions were interpreted to be more focussed either on the influence of financial provision though specific existing policies and legislation (theme: policies and legislation, subtheme: financial provision), or on the immediate availability of or access to funds, that was analysed to be a resource (theme: resources, subtheme: financial). Cultural factors on the macro level were not discussed.

Policies and legislation

This theme included any items that mentioned aspects related to legislation, policy, guidelines (for example from a therapy department), or any barriers to practice related to policies and legislation. The participants discussed policy, financial provision (by policy/legislation), prescription guidelines, red tape, waiting lists, fragmentation barriers and other practice barriers.

Different policies govern AT provision in different settings. Several participants employed in the public sector mentioned the national tender for AT, which stipulates what could be provided at public institutions. AT selection in the public health sector is limited to AT that is stipulated in the tender, bearing in mind budget constraints.

The landscape for the provision of AT appears to be changing within the South African context. Some participants mentioned that financial provision in their environment has increased, while in other environments financial provision was cut. Participant 14 (occupational therapist employed by the public health system) noted, "as X [her place of work] is a tertiary hospital we have been having a lot of budget cuts to allow base/district hospitals more budget for AT issuing". Participant 7 (speech-language therapist employed by public health system), however, had seen an increase in their budget: "We, and other government institutions in Y [province], have recently been given funding to purchase High Tech devices...". Clearly, financial provision has a direct influence on the types of AT provided. Participant 2 (speech-language therapist and audiologist with experience in the public health system) noted, "I mainly used low technology AT (AAC) due to a lack of resources (high technology devices) being on tender, however this recently changed." (According to Cook and Polgar (42,p.7), low technology refers to AT that is "inexpensive, simple to make and easy to obtain"; while Glennen and DeCoste (43,p.379) state that high technology refers to "sophisticated, usually programmable types of equipment"). Furthermore, the differing budgetary allocations as well as priorities at different levels of the health service also influences the AT that will be available. Participant 8 (speech-language therapist employed by public health system) mentioned, "At a PHC [Primary Health Care] level in Y [province] we were given a budget for low tech AT only, and so unfortunately don't use high tech".

In the private health care setting, medical aids may be requested for payment of AT, as described by Participant 1 (occupational therapist employed by AT vendor)

> If the client is purchasing the device through his medical aid, the client will submit the request for the device, usually with a motivation letter. The medical aid will accept or decline the request and inform the client how much they are willing to contribute. The medical aid either pays the client or X [supplier] directly.

An attempt has been made by one province to utilise an electronic monitoring system across hospitals to capture the details of patients as well as details regarding AT issued to them. This aims to keep better track of issued AT. Participant 14 (occupational therapist employed by the public health system) indicated that there have been some difficulties in implementation:

> The system has only been running for a month or two so it is still very new. There are challenges that some hospitals do not have internet or intranet access, which is a major problem in making sure it is used effectively.

The fragmented nature of services provided to children was discussed by several participants. Participant 11, an occupational therapist working in private practice, noted that the service delivery model, particularly in private practice, could be limiting the selection of AT due to the limited teamwork between professionals.

> I would also like to add that the fragmentation or lack of communication between therapists, of different disciplines working with the same child, in the private sector. Therapists working in isolation within their field and therefore the adaptation is not carried over into other areas of the child's functioning to ensure success of the AT...Within the general private practice setting, most medical professionals are working in a medical model. Each only addressing our area of focus and then referring onto another professional to address other areas of function with little or no communication after the initial referral.

Furthermore, therapists mentioned that it is policy to discontinue therapeutic services at

public institutions to children older than 6 years. Participant 7 noted:

> Speech [speech therapy] and OT [occupational therapy] have a protocol where we see patients until Grade R [preparatory year before formal schooling commences, children typically aged 6 years]. There are exceptions as many patients are waiting for placement in special needs schools so [we] would accommodate them. The aim is that learners going into Grade 1 [first year of formal schooling] with specific language, communication and /or learning needs are supported in the school. The reality however is that many schools are not inclusive nor do they have remedial support available.

Unfortunately, the practice of discharging children from therapeutic services when they are older than 6 years of age, leads to the fragmentation of services. Therapists may be unsure whether the child will receive any intervention later on, which could influence the AT that is selected for them. As Participant 6 (speech-language therapist and audiologist providing services at a public hospital) explains:

> In the government sector, children that we see for AAC services (0-6 years) have to be referred to the Department of Education for continued therapy once they turn 6 years of age. This is a factor that we have to consider before we issue an AAC device. It is important that a child has access to continued ST [speech therapy] services once going to school as their AAC system will need to be monitored and continuously updated as their communication needs change. Before we issue a device, we have to consider whether this child will be entering a mainstream or a special-needs school and whether there will be a speech therapist at the school to carry on with the AAC therapy.

Despite policies that should ensure that provision of AT is at least comparable in different public settings, this does not appear to be the case, as provision of AT appears to be quite inconsistent. It appeared that (presumably due to different budgetary allowances) different hospitals/clinics, even within the same geographical area, were able to provide different AT to users, even though, in theory, they had access to similar AT through the tender.

Sometimes, the availability of AT appears to be in the hands of dedicated individuals. Participant 1 (occupational therapist, employed by AT vendor) explained:

> For example, some OT [occupational therapy] HOD's [head of departments] work well with (read: follow-up very regularly and hound) their procurement officers and manage to ensure that their store rooms are consistently full of a range of devices of different sizes. This enables them to issue at the point of assessment in many cases which is wonderful! A few hospitals have even managed to start issuing a chair AND another therapeutic device to children such as side positioners or back positioners, although this is rare. On the other end of the scale we hear about hospitals and clinics where there is a waiting list that is many months and clients long, who have absolutely no stock of devices and have to wait until a delivery arrives. There is such a vast difference in how individual procurement officers/buyers/therapists interact in each health setting that it results in very big differences in what is available, waiting lists etc.

More rural areas may find it especially difficult to ensure stock of devices, ensure good maintenance, access to spares, and so on. Participant 3 (occupational therapist employed within the public health system) explained why her (remote) district never seemed to receive the AT they ordered:

> For example... the X province had a centralized assistive device store, from which all devices for the province, were distributed and which was located in B. When a batch of wheelchairs were due for delivery, the delivery truck got as far as Z [approximately 135km from Participant 3's district] and simply off loaded all of the devices, citing that they were tired of driving as the reason for not covering all the sites as required. The devices were then issued by the staff located in that specific district and never reached our clients at all.

Attitudes

Several participants mentioned that the attitudes of significant people within the environment were important to the selection of AT, particularly the acceptance of the disability and the AT by the family and child themselves. Participant 13 (speech-

language therapist employed by public school system) wrote:

> Acceptance can be very individual. It includes accepting your child with disabilities with the further acceptance of AT that is involved, but also with the learner itself. It is not a rule but smaller kids can be very accepting of their circumstances while the next one has a burning need to walk for example and would not accept anything that might hamper it in their eyes.

Resources

As might have been expected, "resources" was one of the themes that were discussed frequently in the focus groups. Not only financial resources, but aspects pertaining to human resources, such as time were described. Participants mentioned families as a resource, as well as professional/paraprofessional support, the sustained support from professionals/paraprofessionals, teamwork between the family and professionals as well as support from an expert/mentor.

Participants mentioned the importance of access to financial resources to the provision of AT, particularly when high tech AT could be considered. Participant 13 (speech-language therapist employed by the public school system) stated "I think the biggest influence is availability of resources (money) to provide AT for anyone in need". However, participants did not seem to stagnate under the influence of the limited funds on their selections, but rather had a strengths-based perspective characterised by creative problem solving. Participant 5 (physiotherapist employed by the public school system) noted

> As a school, we strongly rely on government funding and donations, and when this is not available, we often 'make do' or become resourceful ;)

Professionals in the focus groups repeatedly referred to the families as a resource in the AT provision process. Professionals utilised the strengths of the family

to a certain extent, for example to help address the shortage of financial resources, or availability of AT.

Participant 15 (speech-language therapist employed at a non-government organisation) mentioned that

> ... money often determines what AT gets implemented for us. The children I see mostly come from families that cannot afford AT but we have been surprised to see that some families will go to the extent of fundraising enough money for eye gaze AAC devices etc.

Several participants referred to the importance of having access to different professional sources of support when providing AT. This should include rehabilitation professionals, as well as paraprofessional support. Participant 9 (occupational therapist employed by public health system) explained her ambitions: "Another wish in my bag is to have a part-time handyman to make all of these great ideas [for custom AT]! haha". Input from an experienced therapist as mentor was also mentioned as influencing provision of AT, although this did not appear to be a frequently used strategy. Several participants spoke of the importance of professionals working together in a team. Participant 1 wrote:

> Collaboration with the child, his family, therapists, teachers and others that interact with him is so important... This ensures that the device that the child receives is appropriate, useful and that it assists the family instead of burdening them.

Furthermore, it was mentioned as important to consider whether a client and his/her family would have access to sustained professionals support after the AT was obtained. Participant 4 (speech-language therapist and audiologist employed in the public health system) mentioned that "Most of these children receive rehabilitation services once a month due to financial constraints as well as lack of human resources in public

institutions". In the public health sector, services are often only provided until the child reaches 6 years of age but are then no longer available. Therefore, children may be dependent on their school to provide the services they need.

Knowledge & information

Participants discussed knowledge and information pertaining to themselves, as well as the child and family.

The knowledge of the parent/family could have a restricting or facilitating effect on AT recommendations. Participant 15 (speech-language therapist employed at a non-government organisation) mentioned that she perceived that parents were not knowledgeable on the benefits of AT (particularly regarding AAC use) and that they sometimes believed myths.

> I sometimes feel like parents accept the ATs that assist their child physically but when it comes to communication they feel like it may be giving up or restricting their child from speaking again.

She explained one case where the parent "was concerned that the child would become lazy and not learn to talk [if they were to use AAC]".

Prior experience of the family or caregivers with AT was identified as helpful, but less experience and skill could limit the selection of AT to simpler devices that are easier to use and maintain. Participant 6 (speech-language therapist and audiologist employed by the public health system) shared her experience after providing a donated iPad™ to a child with communication difficulties:

> In hind sight, we probably should have issued him with a slightly simpler device that his mother could have helped him with (his mother was not very literate/tech-savvy). This is now something that we have to consider before issuing a device.

It was clearly stated that the knowledge of therapists will influence the selection of AT. Training was mentioned as one method to increase knowledge. Participant 9 occupational therapist), also referring to the influence of the fragmentation of services on AT provision, stated:

> I do think that in terms of other types [of] hi-tech AT we in health do not necessarily keep up with what is going on in schools. We are not aware maybe of the fact that children will have access to systems with switches, so we don't actually know if there is anything that we can do to prepare the children for that.

Participant 14 (occupational therapist employed by the public health system) mentioned that the community service therapists employed by government (frequently in rural areas) the year after completing their training, did not have the knowledge or experience to cope with the challenges of providing appropriate AT within the resource limited environment. She wrote:

> Another factor is the knowledge of therapists in rural areas on what is available and effective. There are still quite a few hospitals in X with only comm serves [community service therapists] providing OT [occupational therapy] or speech services. Their knowledge and experience on what AT is available, and how to make or adjust items to reduce costs is limited due to experience and exposure.

Participant 9 added:

> ... I remember from my own comm serve [community service] days that the rural areas often rely on comm serves only. Young therapists simply do not have a lot of experience. It takes a while to get your head around the concept of meeting both the child, family and therapeutic needs with the limited resources available.

As much as factors such as lack of knowledge, and limited training and experience could hamper the provision of appropriate AT, the resourcefulness and skill of therapists in providing appropriate AT were highlighted throughout the discussions.

Many commented on their (sometimes forced) resourcefulness as well as the creativity required to perform their task. Participant 3 (occupational therapist employed within the public health system) wrote:

> Our devices (other than the actual wheelchair...if they come in the size that you ordered) are predominantly hand (and home) made and therefore low-tech, and, more often than not, either hijacked from the pharmacy (boxes), my house or 'modified' general household objects – creativity has become one of our fortes :-).

Referring to simple forms of AT, Participant 16 (physiotherapist, employed in the public health system) noted "... I would not recommend that or purchase, I just do...- that's South Africa". She added that

> ... wanting to reach the best possible outcome will make you seek solutions where you are only facing obstacles or lack of resources - [that] instils creativity in making your own devices.

Participant 3 (occupational therapist employed within the public health system) mentioned how she accessed resources outside of her work context in order to realise her plans

> ... having access to a husband/dad/family member that is able to weld or do woodwork broadens the amount of 'out of the box' thinking that one is able to apply when trying to manufacture or adapt AT devices.

Expectations

The expectation of the family, as well as professionals involved with the family, were mentioned to have an impact on what was recommended. Parents having very high expectations of their child might feel that their child does not require a particular form of AT. Interestingly, one participant mentioned that parents could have very low expectations of the service. This could lead them to accept any AT offered, even

though it may not be the most appropriate. Participant 3 stated:

> This said, I suspect that the long waiting lists and limited variety of devices available result in many of our clients being so thankful for anything (much like the idea of 'beggars can't be choosers'), that they've probably never even considered the potential of something better being available elsewhere.

Preferences and priorities

The preferences of the professionals, the family and the child were mentioned as influencing AT recommendation. Participant 16 referred to the importance of having choices "I think it is also important to emphasise that the users (children and parents) can and should have choices".

Assessment

Regarding the actual AT assessment, it was clear that the assessment approach of the professional played a key role in the entire process. Several practitioners, particularly those employed in the private sector, indicated a more multi-disciplinary approach to assessment, with therapists conducting their assessments without the input from other professionals, although the family was reported to be incorporated in the process.

Several participants, particularly those employed in the public health/education sectors indicated that they have a more collaborative approach towards the assessment, with several indicating that they conduct assessments together with other professionals, with parents also playing a prominent role. Participant 4 described their approach at a tertiary public hospital: "We aim to provide family-centered services, that strongly considers the needs and environmental context of families".

Obtaining information on the needs of the family as part of the assessment was highlighted as important. Participant 10 (physiotherapist with experience in several

working contexts) wrote:

> We will also discuss any suggestions our team might have re AT based on the parents goals, needs or long term management. It is my experience that it is essential to establish caregiver requirements if AT is to be used effectively.

She continued that this was needed in order to "ease the strain on the caregiver, facilitate the relationship [with the child]". None of the participants reported asking the children regarding their needs directly - most referred to their perceived needs of the child.

Furthermore, the majority of therapists tended to have a functional approach to the assessment for selection of AT for young children. Several indicated that activities of typical children could be used as a guide. Participant 9 provided a clear example:

> I have to keep developmental stage in mind, because even children with severe disabilities grow up in some way. One obvious example will be to start thinking about standing frames for some children by about 12 -15 months, because standing is important for both postural and skeletal development and is a good alternative functional position at that age.

As could be expected, the environment where the AT would be used was frequently described as a consideration during the selection process. Participants explained aspects related to the immediate home/school/hospital environment, as well as the broader community environment where AT would be used. As example, Participant 6 (speech-language therapist and audiologist employed by the public health system) explained: "... some patients do not have electricity at home, which might influence the issuing of devices that require regular charging (such as tablets/ipads)".

Therapists explained that home or school visits were frequently used to ensure a good match between the child and the AT. Occasionally, therapists were disappointed by

non-use of devices, only to find out that they had not considered the environment of the child comprehensively. Participant 5 (physiotherapist employed by the public school system) provided a clear example:

> Another point which should be considered is the amount of space available within the child's home. A colleague and I were shocked to find that a standing frame which had been sent home for the holidays, was kept outside the home of the child, because of a lack of space being available inside the home.

In addition to the immediate physical environment, therapists also have to consider the environment where the child is expected to participate - even if this will only be sometime in the future. Participant 9 provided an interesting example

> I have noticed by the speech therapist that works with me that the type of communication systems that is used in the schools that the children may end up going to mainly determines what she implements early on. For instance, even though a certain child with autism may do very well with using signs, she needs to push him to use PECS [Picture Exchange Communication System], because the schools in the area only use PECS [Picture Exchange Communication System].

Furthermore, the wider community factors were also mentioned, indicating the need to also incorporate community assessment into the AT selection process. For example, the safety of the child and the AT is an important consideration within certain communities. Participant 15 added: "Another point is the risk of expensive AT being stolen. Although I don't like this to limit a child, in South Africa this is an obvious threat". Participant 8 (speech-language therapist employed by public health system) explained her solution: "Low tech AT works well in the setting as the children are able to take their files, visual schedules, or adapted games home without fear of them being damaged or stolen".

AT

The AT itself appeared to be a very important consideration for therapists and it was frequently discussed. Several subthemes were identified, as shown in Table 3. Participant 3 (occupational therapist employed within the public health system) summed up the importance of the availability of AT by stating:

> One of the greatest driving factors of AT provision / recommendation for me is probably the availability of the device. Although one might be aware of a more suitable option, we often end up being limited to what is available / what can be made.

Within the South African context, different AT may be available depending on the specific healthcare system and institution (for example hospital or clinic) that a child accesses. Several inconsistencies were identified, that seemed to be dictated by the budgets and priorities of the different institutions, as well as the skill and motivation of staff. Institutions also appeared to have different procurement procedures, with some seemingly ordering AT yearly and others more frequently. The procurement procedure would determine the stock of AT at a particular institution at a specific time, which would dictate whether a particular piece of AT could be provided immediately and what the possible waiting time (if any) would be. Those that cannot be issued with the AT required, are placed on a waiting list.

When stock of devices or financial resources are limited, or a child is on a waiting list for AT therapists use whatever they have available to assist. Participant 5 (physiotherapist employed by the public school system) mentioned

> While waiting on chairs, we try and seat our learners as best we can, with the equipment that we have. With learners who have outgrown their chairs, we would sometimes seat them in a bigger chair and then add lateral supports to provide the stability they need, or 'mix and match' footrests etc.

Participants mentioned numerous examples of readily available scrap materials, household objects, cardboard etc. that they utilise to create or adapt AT. Applied paper technology (APT) is used to create adapted chairs or standing frames, as the cardboard, paper and glue needed for this process is relatively cheap and readily available.

Physical location appears to influence the availability of AT and sometimes even of basic supplies - Participant 3 (occupational therapist employed within the public health system) noted

> I think... living in an area which is quite isolated, limits access to various materials etc. So for example if a child needs a seating insert or positioner, that would be best if made out of high density sponge...due to where we live and the shops which are available, I am unable to access the correct materials without physically driving 100km in order to access them, so the child may end up with something made of a lower density sponge /pieced together packaging materials / APT device instead."

The availability to trial AT before purchase was identified as an important factor by several participants. Within the South African context, this is not always possible due to limited availability of AT, although several therapists indicated that they do manage to have a trial before purchase/provision. Certain institutions have started implementing trial periods of AT use, where the AT is only issued to the child after it has been found to be appropriate after trial. If the issuing hospital has a large stock of devices, it may be able to swop out a device if it is found unsuitable after trial. Participant 6, employed at a public institution implementing extended trials before issuing AT stated:

> It [having a trial] also takes a lot of the pressure off the therapist who is recommending the device. Sometimes, we are not always 100% sure if the patient will do best on a 4-grid or a 9-grid [communication device]. It's only until you've really given it a chance in therapy that you know. The devices are expensive and one feels a lot of pressure to make sure that the devices we issue meet the needs of the child.

Within the multi-cultural South African context, several comments emphasising the importance of cultural appropriateness of the AT were made. During the discussions, this was applied particularly to AAC and selected symbols and languages. Available symbols (e.g. from existing symbol libraries) are often not culturally appropriate and therefore the AT should have the option of being adapted to the local context. Participant 12 (speech-language therapist and audiologist in private practice) indicated as an example that she "might need to replace [the symbol of] Santa with Father Christmas, and [the symbol of] van with taxi". Participant 4 (speech-language therapist and audiologist employed within the public health system) indicated that ensuring the cultural appropriateness of the AT was a consultative process

> Therefore we consult the family members on the appropriateness of the pictures (type of pictures as well as daily activities of living). Sometimes we have to get pictures from the internet to depict for similar bathroom environment. For example, we may have to combine a bucket with water and a child washing themselves next to it. We also ask the parent if the pictures would be easily identifiable by other family members.

In a context were most clients are not English first language speakers, having access to mostly English communication devices/voices becomes a significant factor to consider when selecting AT. Participant 4 (speech-language therapist and audiologist, providing services at a public hospital to children from multiple language groups) summed it up by stating that "The device should also be congruent with the language preference of the child and family".

The cost of the AT was another consideration mentioned. Participant 15 stated: "We are somewhat limited by the cost of devices which makes high-tech devices difficult for us to access". Low cost materials are often selected, even though they may take long to make. Participant 8 described the benefits:

> Although, it takes time to make low tech communication files they are relatively cheap and copies can then be made available and kept at home and at school, or the file [could be] transported between the two without fear of theft.

The discussion introduced the idea that the flexibility and adaptability of the AT was an important aspect to consider for a young child, particularly within a context with limited resources. Participant 10 (physiotherapist with experience in multiple contexts) explained: "I am in favour of low cost equipment or equipment that can "grow" with the child. Especially in these early years where the child's requirements will change fairly rapidly". Participant 12 (speech-language therapist and audiologist in private practice) indicated that size matters: "When it comes to size, is it portable or huge ... will it fit in a school bag if he/she is in nursery or crèche".

Low technology options were preferred by some as they were cheaper and proved to be quite adaptable. Participant 7 (speech-language therapist, employed by public health system) stated: "We found that Low tech AAC have been a bit more easier to manage, control and is more flexible in addressing the changing needs...".

Decision making

Three subthemes were indentified under decision making, describing the professional as the primary decision maker, the family as the primary decision maker, and a collaborative and joint decision making process with responsibility being shared between the family and professionals. Participant 4 (speech-language therapist and audiologist, employed within the public health system) explained her approach

> Once an appropriate device is selected together with the family member, the device is then trialled with the child for several sessions.

Discussion

The data illustrated the complexity of factors that have an influence on the selection and provision of AT to young children within South Africa. As indicated by the AT Device Selection framework (13), this process is multifaceted and should incorporate environmental factors as well as personal factors (pertaining to the child and family, as well as the professional) into the assessment and AT decision making process.

Regarding factors within the broader environmental context, it appeared as though participants were very cognisant of the important influence of this on the selection of AT, particularly relating to policies and legislation, also mentioning several barriers to practice related to these aspects. Extensive examples were provided of how these factors can dictate particularly the availability, accessibility and affordability of appropriate AT to families and children. In public health settings, the inconsistency of services between different settings was highlighted. Consistent policy implementation in all parts of the country will ensure a consistent AT service. Addressing the fragmentation of AT services, also described by Visagie et al. (44), can ensure that best use is made of available resources. Importantly, children and families should not experience a disruption in services during transitions, ensuring seamless intervention as recommended as principle for services to all young children (45). For example, transition planning should be initiated when children move between the public health system to the education system when they reach school going age. Where fragmentation in service is created due to professionals not working in teams with other professionals, professionals should aim to increase their collaboration with others, as teamwork has been described as best practice (14,46,47) when recommending AT to young children.

Interestingly, the participants did not much discuss the broader cultural aspects that influence provision of AT. Professionals seemed to focus their attention on the

level of the family (their specific preferences), but not in terms of the wider cultural backdrop in which AT provision takes place. Culture was mentioned when relating to the appropriateness of specific devices for a specific child from a specific cultural and language group (for example AAC devices and the symbols used). Continued efforts to increase cultural competence can assist rehabilitation professionals to continue to grow in their understanding of how the culture of the children and families they serve influences the selection and eventual use of AT.

In alignment with a strength-based perspective, participants indicated that they viewed the strengths of the family as a resource in the process of AT provision, particularly in obtaining access to funding. The skill and experience of the family/caregivers can also be utilised as a strength when AT is being selected. Unfortunately, family/caregivers may not necessarily be skilled within a country with a considerable part of the adult population not literate or technologically skilled. Families may require extensive training and sustained professional support after the provision of AT to enable them to utilise it. The availability of such training and support may be particularly important when provision of more complex technology is considered. Providing parents with information dispelling myths regarding AT may also be indicated. Low technology and low cost options may be simpler and could be more appropriate, if they are able to fulfil the same purpose as high technology options.

Regarding the knowledge and experience, skills and training of therapists, the participants indicated the importance of keeping up to date with new developments in the field. This may have become particularly difficult in recent times with the expansion of technology. Close collaborations between AT vendors and rehabilitation professionals will allow vendors to provide guidance to professionals regarding specific products and their provision and use within the South African context. Furthermore,

opportunities for formal training could be created by individual professionals/institutions/vendors that are experienced in the context to address the need of professionals to expand their knowledge on AT and AT selection. Facilitating opportunities for rehabilitation professionals to expand their knowledge in the field of AT is vitally important (48–51) and could contribute to greater feelings of self efficacy in recommending professionals (52).

Formalised methods of support, such as reflective supervision or mentorship programmes could be utilised, particularly by young therapists entering this challenging field. Such practices are described as essential to ensure evidence-based practices when providing services to young children (53–55). As the importance of creativity and resourcefulness of therapists were highlighted during the discussion, these traits could be nurtured in a reflective supervision relationship in order to facilitate creative solutions to complex challenges. Creativity and resourcefulness could be encouraged by managers and trainers, by providing, for example, support in the form of technicians, or training in creating low cost AT solutions.

This study has also suggested the importance of factors related directly to the AT that could be used to expand the AT Device Selection model. AT itself is considered in other models for AT selection (54, 55). The characteristics of AT itself appears to be highly important when making recommendations to children with disabilities in resource limited environments such as South Africa where reasonably basic aspects such as access to electricity to charge AT or finances to replace batteries become important considerations. It is important to continue to look at ways to lower the costs related to AT and to ensure that available AT is not only appropriate, but relevant to the specific context (57). Low technology options (often self made and low cost), should not necessarily be viewed as inferior to high technology (and often more

expensive) options (58,59). Furthermore, locally produced AT products (when available) may be a cost-effective alternative. Research efforts are required to support therapists in their selection decisions of low cost options, to ensure that they are based on evidence-based practises, for example Bastable et al. (60) .

Effective practices, such as the availability of AT for trail during assessment, or the use of AT for a trial period should be widely incorporated, as recommended in the literature (61,62) . In this regard the establishment of AT libraries by vendors or perhaps large hospitals/training institutions may be explored, in order to provide families the option to trial a piece of AT. This initiative has been started but has great potential for growth.

Regarding assessment, the use of home and school visits are very important in ensuring a good match is made between AT and child within the particular family context. Home visits become particularly important in a context where professionals themselves may not be familiar with, for example, the home environment of a child as it may differ significantly from what is familiar to them. This practice may provide the professional with the opportunity to observe the child performing in their natural environment (15,51) and has been suggested as a way to facilitate the expansion of cultural competence (63).

Furthermore, the importance of family-centered AT decision making was described, particularly to ensure the appropriateness of the AT, as well as the practicality of use. This, however, does not mean families need to make the decisions regarding AT on their own, but implies that the process occurs within a team that is able to support the family in their decision. Importantly, a broad definition of family should be applied, with biological parents, grandparents, siblings and other caregivers included.

Particularly in light of the import role of the family in the AT selection and decision making process, a limitation of this study is that it only focussed on the perspectives of professionals. This may be addressed in future studies in order to gain insight into the perspectives of families involved in this process.

Conclusions

The findings from this study illustrate the complexity of the AT selection process and could be used to expand the AT Device Selection Framework (13) for application to low resourced environments. Multiple factors play a role in the AT selection process that all have to be integrated and weighed up by the recommending rehabilitation professional. A considerable amount of clinical reasoning is required to ensure an appropriate match between the child and family (as users), and AT required for optimal functioning within a specific environment - all within a low resourced setting. Professionals responding to this challenge by incorporating firstly established best practices for working with young children, and complementing this with their own creativity and resourcefulness are able to work towards solutions to provide appropriate AT to young children in low resourced environments.

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Declaration of interest

The authors report no conflicts of interest.

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