Inclusive education: The case for early identification and early intervention in assistive technology

Paula Frederica Hunt, MEd, PhD
Disability Education and Development, Lda, Leiria, Portugal

ABSTRACT
This paper starts by presenting the argument that inclusive education for learners with disabilities is often not possible without their access to fit-for-purpose assistive technology (AT), as the barriers to their education are often environmental.

The paper will argue that, if assistive technology is an enabler for learning, then the processes by which children with disabilities are identified as users of assistive technology must take place as early as possible in the lifecycle. Mechanisms associated with Early Identification and Early Intervention (EI/EI) must be outfitted with all necessary resources for identifying and addressing the unique assistive technology needs of each individual child, but also have a prospective view of the use of the assistive technology in order to ensure school-age children start benefiting from assistive technology as early as possible.

A further argument will be made that, when adequate identification of the need for assistive technology has not taken place early, education systems must be prepared to – in collaboration with other ministries or departments – identify, assess and provide the necessary assistive technology not only as it relates to education use, but to all-inclusive and holistic use. The argument will be made for adequately resourcing “support services for inclusion” and creating transdisciplinary teams of professionals that can effectively ensure equitable access and participation of all children with disabilities in inclusive education.

Throughout, some examples of good practices will support the narrative, and the paper will close with recommendations for stakeholders involved in developing policies and practices for inclusive education.

The crisis in “access and equity” has been in evidence for a number of years, as reported in the number of children with disabilities who are out of school; perhaps as many as one-third of all out-of-school children are children with disabilities (World Bank, 2019). The “quality and learning” crisis has also been evidenced by the number of children with disabilities who are likely to drop out, not pursue education beyond primary schooling, or graduate without acquiring minimum learning skills (World Bank, 2019). Additionally, it can now be argued that the situation has become exponentially worse due to school disruptions related to the COVID-19 pandemic.

Barriers to education

Partially to blame for the “learning crisis” (World Bank, 2018) is the narrow conceptual understanding of inclusion that leads many governments to provide access to education (a surface level understanding of inclusion), while few governments can ensure the right to education to all, understood as “access, presence, participation and success” (Slee, 2018). As documented in the Global Education Monitoring Report (UNESCO, 2020), many education systems are limited in their capacity to respond to diversity.
The resulting integration⁴ of children with disabilities and children from other marginalized populations within existing systems, leads to limited access to education, and only to those who can fit within its existing structures and mechanisms.

Additionally, children with disabilities face other barriers to education. Many children are excluded from learning opportunities due to stigma and discrimination; others, due to disabling environments; inflexible education systems and complex combinations of all these factors (UNICEF, 2013) (World Bank, 2018) also act as barriers. These barriers have existed for decades, and persist, despite various international treaties, conventions and calls to action that place great responsibility upon governments with regards to the right of all children – including children with disabilities – to inclusive education.²

While some of these barriers have been identified and are being addressed to varying extents, others are only partially recognized and addressed. For example, the barriers created by inflexible systems are being addressed by UNESCO IIEP, the World Bank, UNICEF and the Global Partnership for Education (GPE) through their collective efforts to develop the Education Sector Analysis Methodological Guidelines – Volume 3 (unpublished). Barriers created by disabling environments for children with physical impairments are being identified and, often, ramps are being constructed to ensure their access to a school building. However, while reflecting a positive trend, interventions such as these – reactions to identified needs as opposed to proactive in consideration of universal design – denote a narrow understanding of accessibility and retrofitting which is not ideal.

Children’s rights to assistive technology and to inclusive education

The Convention on the Rights of the Child (UN Commission on Human Rights, 1990), the Convention on the Rights of Persons with Disabilities (UN General Assembly, 2007), and the Sustainable Development Goals (SDGs) (UN General Assembly, 2015) are all clear in their message: all children – including children with disabilities – have the right to an education, without discrimination, and on an equal basis with others. Quality education should be provided in inclusive settings, taking into consideration equity measures.

In addition, all three frameworks make mention of (assistive) technology as a right:

the CRC, in Article 24.2 c mentions that “application of readily available technology” (UN Commission on Human Rights, 1990) is required not only within the context of combating disease and malnutrition but also in support of their right to education on an equal basis with others (Article 28).

the CRPD mention in Article 20 the State Parties’ obligation to provide “quality mobility aids, devices, assistive technologies and forms of live assistance and intermediaries, including by making them available at affordable cost” (UN General Assembly, 2007); likewise, when understood inter-alia, supports their use in support of Article 24 (Right to Education).

the SDGs, particularly SGD 4 (Education), SGD 6 (Clean Water and Sanitation), SGD 7 (Affordable clean energy), SGD 9 (Industry, Innovation and Infrastructure) in target c (access to ICTs), SGD 10 (reduced inequalities), and in SGD 11 (Sustainable Cities and Communities) (UN General Assembly, 2015) (UNDESA, Advance Unedited Version). While SGD 4 and SGD 9 are explicit in their mentions of assistive technology as a vehicle to overcome barriers to education, SDGs 6, 7, 9 10 and 11, support the arguments that (1) assistive technologies are essential in providing adequate WASH facilities in schools, (2) access to clean energies is necessary to access ICTs – and the technologies and products necessary for their use – and, (3) assistive technologies are an unconditional requirement for ensuring that children with disabilities access education on an equal basis with others, an essential condition for the development of inclusive societies. Moreover, the above frameworks, when interpreted collectively, convey a transformative way of understanding education, whereby education is understood to be a right in itself, and the mechanism by which all other rights can be fulfilled. Within the framework of Agenda 2030, this is only possible when education and technology intersect. Education is not just a question of access, but it is also a reflection of – and reflected in – universal presence and participation, and personal success and fulfillment. For this right to be implemented governments must ensure that schools have access to, among other things, “(a) electricity; (b) internet for pedagogical purposes; (c) computers for pedagogical purposes; (d) adapted infrastructure and materials for students with disabilities” (UN Statistics Division, n.d.).

Mediating the inclusion of children with disabilities in education

This paper argues that many children (including many children with disabilities, but not exclusively) will only be able to experience education in its broader sense – access, presence, participation and success – if they are provided with the tools (devices and technologies) that can support them in overcoming the barriers that act as obstacles or disabling conditions. While, in many cases, assistive technologies are critical for access to education, they are equally important for presence, participation and success; they can allow children to engage with the world around them, enjoy familial and personal relationships, and develop independence and wellbeing (World Health Organization, n.d.).

⁴Integration is defined in CRPD GC4 as “the process of placing persons with disabilities in existing mainstream educational institutions with the understanding that they can adjust to the standardized requirements of such institutions” (p. 3).

²Inclusive education is defined in CRPD GC4 as “a process of systemic reform embodying changes and modifications in content, teaching methods, approaches, structures and strategies in education to overcome barriers with a vision serving to provide all students of the relevant age range with an equitable and participatory learning experience and the environment that best corresponds to their requirements and preferences. Placing students with disabilities within mainstream classes without accompanying structural changes to, for example, organization, curriculum and teaching and learning strategies, does not constitute inclusion”.

---

The resulting integration of children with disabilities and children from other marginalized populations within existing systems, leads to limited access to education, and only to those who can fit within its existing structures and mechanisms.

Additionally, children with disabilities face other barriers to education. Many children are excluded from learning opportunities due to stigma and discrimination; others, due to disabling environments; inflexible education systems and complex combinations of all these factors (UNICEF, 2013) (World Bank, 2018) also act as barriers. These barriers have existed for decades, and persist, despite various international treaties, conventions and calls to action that place great responsibility upon governments with regards to the right of all children – including children with disabilities – to inclusive education.

While some of these barriers have been identified and are being addressed to varying extents, others are only partially recognized and addressed. For example, the barriers created by inflexible systems are being addressed by UNESCO IIEP, the World Bank, UNICEF and the Global Partnership for Education (GPE) through their collective efforts to develop the Education Sector Analysis Methodological Guidelines – Volume 3 (unpublished). Barriers created by disabling environments for children with physical impairments are being identified and, often, ramps are being constructed to ensure their access to a school building. However, while reflecting a positive trend, interventions such as these – reactions to identified needs as opposed to proactive in consideration of universal design – denote a narrow understanding of accessibility and retrofitting which is not ideal.

Children’s rights to assistive technology and to inclusive education

The Convention on the Rights of the Child (UN Commission on Human Rights, 1990), the Convention on the Rights of Persons with Disabilities (UN General Assembly, 2007), and the Sustainable Development Goals (SDGs) (UN General Assembly, 2015) are all clear in their message: all children – including children with disabilities – have the right to an education, without discrimination, and on an equal basis with others. Quality education should be provided in inclusive settings, taking into consideration equity measures.

In addition, all three frameworks make mention of (assistive) technology as a right:

the CRC, in Article 24.2 c mentions that “application of readily available technology” (UN Commission on Human Rights, 1990) is required not only within the context of combating disease and malnutrition but also in support of their right to education on an equal basis with others (Article 28).

the CRPD mention in Article 20 the State Parties’ obligation to provide “quality mobility aids, devices, assistive technologies and forms of live assistance and intermediaries, including by making them available at affordable cost” (UN General Assembly, 2007); likewise, when understood inter-alia, supports their use in support of Article 24 (Right to Education).

the SDGs, particularly SGD 4 (Education), SGD 6 (Clean Water and Sanitation), SGD 7 (Affordable clean energy), SGD 9 (Industry, Innovation and Infrastructure) in target c (access to ICTs), SGD 10 (reduced inequalities), and in SGD 11 (Sustainable Cities and Communities) (UN General Assembly, 2015) (UNDESA, Advance Unedited Version). While SGD 4 and SGD 9 are explicit in their mentions of assistive technology as a vehicle to overcome barriers to education, SDGs 6, 7, 9 10 and 11, support the arguments that (1) assistive technologies are essential in providing adequate WASH facilities in schools, (2) access to clean energies is necessary to access ICTs – and the technologies and products necessary for their use – and, (3) assistive technologies are an unconditional requirement for ensuring that children with disabilities access education on an equal basis with others, an essential condition for the development of inclusive societies. Moreover, the above frameworks, when interpreted collectively, convey a transformative way of understanding education, whereby education is understood to be a right in itself, and the mechanism by which all other rights can be fulfilled. Within the framework of Agenda 2030, this is only possible when education and technology intersect. Education is not just a question of access, but it is also a reflection of – and reflected in – universal presence and participation, and personal success and fulfillment. For this right to be implemented governments must ensure that schools have access to, among other things, “(a) electricity; (b) internet for pedagogical purposes; (c) computers for pedagogical purposes; (d) adapted infrastructure and materials for students with disabilities” (UN Statistics Division, n.d.).

Mediating the inclusion of children with disabilities in education

This paper argues that many children (including many children with disabilities, but not exclusively) will only be able to experience education in its broader sense – access, presence, participation and success – if they are provided with the tools (devices and technologies) that can support them in overcoming the barriers that act as obstacles or disabling conditions. While, in many cases, assistive technologies are critical for access to education, they are equally important for presence, participation and success; they can allow children to engage with the world around them, enjoy familial and personal relationships, and develop independence and wellbeing (World Health Organization, n.d.).

---

¹Integration is defined in CRPD GC4 as “the process of placing persons with disabilities in existing mainstream educational institutions with the understanding that they can adjust to the standardized requirements of such institutions” (p. 3).

²Inclusive education is defined in CRPD GC4 as “a process of systemic reform embodying changes and modifications in content, teaching methods, approaches, structures and strategies in education to overcome barriers with a vision serving to provide all students of the relevant age range with an equitable and participatory learning experience and the environment that best corresponds to their requirements and preferences. Placing students with disabilities within mainstream classes without accompanying structural changes to, for example, organization, curriculum and teaching and learning strategies, does not constitute inclusion”. 
While the lack of enabling environments is often identified as the main barrier to access to education for children with disabilities, full participation and success can be severely compromised due to difficulties in mediating learning as evidenced by the large number of children with disabilities estimated to not graduating, or graduating without mastering the essential skills that can lead to tertiary education and/or constructive and prosperous work (World Bank, 2019).

However, AT can prove essential in ensuring that children – particularly children with disabilities – participate and succeed in the learning and living processes. When culturally appropriate, incorporated within the principles of universal design for learning (UDL), and in complement of “reasonable accommodations,” both low- and high-tech AT can support the learning process (Tamakloe, 2020).

**Benefits of assistive technology in education**

According to recommendations from UNESCO, “it is most useful to consider both UDL and AT as tools for accessing high quality inclusive education which enables all learners to achieve their full (learning) potential rather than aims in their own right” (Hersh, 2020). High-tech AT is usually technologically advanced, often requires electricity and can be costly. Low-tech AT is also considered cost-effective and can be easily adapted to children. However, regardless of the type of AT to be considered, it is imperative that the identification of the AT be completed as early as possible in the life of a child to ensure that, not only the young child interacts as much as possible with the world around them, but also ensure that by the time they enter school, the use of a needed piece of AT is already instinctive and does not create an additional barrier (Tamakloe, 2020).

As widely demonstrated by WHO & UNICEF (2015) there are many benefits to children having access to AT. Some products are to be used across all areas of life (e.g., hearing aids) and have implications that often go well beyond the school walls, as they impact their independence, self-image and even the ways in which others perceive disability (Borg et al., 2012). Directly or indirectly, using AT to overcome barriers to education, can have an impact in cost reduction, by promoting and ensuring access to independent living and employment, and less reliance on social security (World Health Organization & World Bank, 2011) (Netherton & Deal, 2006) (SIAT, 2013 as cited in WHO & UNICEF, 2015).

However, other assistive technologies and/or products have specific application to education and education-related tasks, and can impact access, presence, participation and/or the success of children with (and without) disabilities (UNICEF, n.d. b). Assistive products such as the Cboard (Cboard, n.d.) can aid speech development and communication, thus promoting participation in and outside the education environment. Other products, such as UNICEF’s Accessible Digital Textbooks (UNICEF, n.d.a), promote reading and literacy development by providing access to print books in multiple formats that, although designed for children with disabilities, can be used by all children. Assistive technology in the form of applications (smart phones and tablets) can allow children access to information, increase motivation and decrease stigma in children with reading difficulties (Lindeblad et al., 2017). Braille type-writers, speech-to-text technology and talking watches are essential to education access of children with visual impairments (Senjam et al., 2020). Teachers report that sound-field systems and FM systems often used to support children who are deaf or hard of hearing in the classroom are beneficial for all students, improving behavior and attention (Nelson et al., 2013).

**Early identification of assistive technology as precursor for success**

While the importance of early learning/school readiness and the Early Identification and Early Intervention (EI/EI) (UN General Assembly, 2007) of children with disabilities or those at risk of a disability or delay is well documented (WHO & UNICEF, 2012) (World Health Organization, 2012), the research often fails to include mention of assistive technology, or indicates only those instances that have become normalized (e.g., Braille support for children who are blind, Sign Language for children who are Deaf). Other interventions, particularly those less tangible – but no less instrumental – for children with intellectual or mental disabilities as well as sensory are overlooked (IDA Inclusive Education Task Team, 2020). In addition, mentions of assistive technology tend to become more frequent as the child ages and enters schooling age, and education-related needs become more explicit (Long et al., 2003). This has perhaps contributed to a narrow understanding of assistive technology as products with a mechanical component, that are high-tech, or that are needed when a child begins their schooling.

If assistive technology is to be fully understood as an enabler for learning and living, then the processes by which children with disabilities are identified as users of assistive technology must take place as early as possible in the lifecycle such as through newborn hearing screening, be tailored to the individual, and fit-for-purpose (World Health Organization, 2001) (Hollenweger, 2018). While early intervention and AT have the potential to reduce the risks and obstacles for children with disabilities, “the impact of a particular AT solution depends largely on the aspirations and individual characteristics of the user. There is not one AT solution that fits all; what works for one user might not work at all for another” (Witte et al., 2018).

Global research indicates that the first 5 years of life are crucial for growth in all developmental areas. Young children learn about the world and develop their abilities by interacting with the world around them, both at home with their parents and families and in their most immediate surroundings (Marope & Kaga, 2015). However, growth patterns are unique to each child’s experiences and progression through the expected milestones can sometimes be hampered (WHO & UNICEF, 2012). When this is the case, among other variables, AT should be considered, particularly if it has the potential to enhance a child’s quality of life and enhance their development.

Assistive technology can support young children in a variety of ways: by supporting speech and language; the acquisition of new skills; by creating supportive environments; by increasing independence in everyday activities; by empowering parents and other family members; and by
increasing the quality of life (Mistrett et al., 2005). Assistive technology, if understood as the total sum of an item, its modification, and/or the strategy for its use, can support a child who is blind in identifying objects, can provide a means of movement around their house for a child with a physical impairment, and can allow a young child with fine motor difficulties the ability to use a toy (with large buttons). But it can also support a child and the mother at feeding time or help to create opportunities for children with specific impairments to play with others. However, the determination as to which AT is adequate, cost-effective and easy to use requires a team effort that should be undertaken by an Early Identification and Early Intervention (EI/EI) team (Mistrett et al., 2005). While some AT have become common place and are readily identifiable and easy to purchase (e.g., seeing eyeglasses) others are more complex and should take into consideration not only the child and the impairment, but also the environment in which the child lives and the participation restrictions (Scherer & Craddock, 2002).

Tamakloe (2020) describes EI/EI as an inclusive service delivery system that supports young children and their families, with the objective of maximizing participation, removing barriers to “promote full involvement in learning activities” (p. 143). As a delivery system, EI/EI are best institutionalized when various specialists representing multiple disciplines come together to assess and identify a possible delay or disability (WHO, 2012). The more diverse the team of specialists, and the more engaged the family, the better are the chances that adequate services be identified, planned for and provided. The diversity of expertise should include not only health and social protection experts but also include education experts, no matter how early in the life of the child a disability or delay are identified. Including an education specialist early on provides the transdisciplinary team with a future outlook that takes into account access, presence, participation and success in education, establishes a team that can provide holistic services throughout the life-cycle, and supports continuity of communication and referral among and across different life activities (Boavida et al., 2015). For this, mechanisms associated with EI/EI should be outfitted with all necessary resources (human, financial and technical) for identifying each individual child’s need for assistive technology, as well as have a prospective view of the use of the assistive technology in order to ensure children start benefiting from assistive technology as early as possible. Early learning and school readiness are only possible when children are provided with the AT needed for mediating learning as early as possible in the life of the child (Santos & Nunes, 2015).

**EI/EI – the case of Portugal**

In Portugal, the National System of Early Intervention in Childhood (DGS – Direção Geral de Saúde & Serviço Nacional de Saúde, n.d.) has been legislated since 2009, as a set of coordinated actions by the Ministry of Labor and Social Solidarity, Ministry of Education, and Ministry of Health, with families and the community. It aims to ensure the implementation of a group of measures for holistic support centered in the family and child, including measures in prevention, rehabilitation, education, health and social intervention for families with children at risk of a delay or disability (SNIPi – Sistema Nacional de Intervenção Precoce na Infância, n.d.).

Activating the EI/EI mechanism is the responsibility of local transdisciplinary teams of professionals ( Equipas Locais de Intervenção – ELI) that are responsible for the development of an Individualized Plan of Early Intervention. This team of professionals usually has a case-manager dedicated to a particular child, a professional that ensures continuity of care throughout the life of the child. In addition, the team includes a psychologist, a pre-school/kindergarten teacher, a social worker, a speech therapist and an occupational therapist. The case-manager is responsible for maintaining the communication between the team, the child/family and others, which can include the involvement of other community-level services that are (or might be) needed, such as kindergarten and/or after school care. In addition, a multitude of external services and professionals can also be called upon to be a part of the team, such as pediatrician, nurses, physicians specialized in a particular area, the family doctor, etc.

In Portugal, the identification, assessment for, and provision of assistive technology falls within the professional realm of the occupational therapist (OT), within a collaborative environment. Thus, the OT who integrates a local team (ELI) is responsible for helping to identify and assess the needs of children in seven domains (Associação Portuguesa de Terapeutas Ocupacionais, n.d.):

- Promoting daily living skills for independence;
- Stimulating cognition (memory, attention, concentration, problem solving, etc);
- Promoting motor competencies (muscle, movement, coordination, balance, fine motor, dexterity, etc);
- Sensory integration;
- Promoting the development of psycho-social competencies;
- Environmental adaptations (architectural barriers) and practice using technical aids; and,
- Advising, development and practice using support products.

According to this varied set or responsibilities, and within EI/EI, an OT might be able to create the conditions for a young child (0 to 6 years old) to engage with her/his family, friends and school readiness environments.

The literature confirms that “matching assistive technology products must include a needs assessment process with appropriate assessment instruments and personnel who are trained to work with people with disabilities” (Smith et al., 2018, p. 5). Equally important is to ensure that matching a child with the most appropriate AT, and training in the use of AT, involves not only the child but also the extended family and all those who will be, in one way or another, impacted by the use of the AT. Merging AT in the life of a child can have a dramatic impact not only in terms of the practical aspects of the life child and family, but it can also change the ways in which people understand and deal with a disability (Desmond et al., 2018). Therefore, considerations of how AT might impact
self-image, stigma and discrimination must be made prior to decisions on use: “Culturally sensitive and culturally competent AT provision is essential” (Desmond et al., 2018, p. 3).

**Education systems as mechanisms for adequate identification**

When adequate identification of assistive technology has not taken place at an early age, education systems must be prepared to – in collaboration with other ministries – identify, assess and provide the necessary assistive technology. However, as it would be the case in early childhood, the identification and provision of assistive technology should not be restricted to education use, but rather be provided for use by the child in all settings and situations, above and beyond education applications.

However, while many countries already have established means of identifying, assessing and planning for responding to the needs of children with disabilities, provisions related to AT are not always taken into consideration. Even in countries where federal law mandates that service plans (either related to early intervention or individualized education) include consideration of assistive technology, the overall uptake is low. For example, in the USA between 1997 and 2001, “less than 4% of infants and toddlers (0–3) in early intervention programs had an AT device or service” (Mistrett et al., 2005, p. 281). While it is expected that the situation has improved over the last 20 years, it is likely that AT considerations remain low before (and often during) school age due to the reported barriers to use (Karlsson et al., 2017) (Atanga et al., 2019). There are many obstacles to the adequate use of AT and these barriers are discussed at length elsewhere. However, two reasons for lack of AT use are important to identify in this discussion.

First, many impairments and disabilities only manifest in primary school. While low-incidence impairments (e.g., blindness, deafness, paralysis, non-verbal communication) tend to be identified at birth or shortly thereafter, high-incidence disabilities (speech and language difficulties, dyslexia, dyscalculia, learning disabilities) are likely to be acquired through the life of the child, or are not identified and/or assessed until a child enters primary schooling and patterns of lack of school success start emerging (Otaiba & Petscher, 2020). For example, dyslexia may not be fully identified and assessed until the second grade, when reading fluency is expected (International Dyslexia Association, 2019). Likewise, an intellectual disability may not manifest until a child is expected to make decisions by her/himself (Marrus & Hall, 2017).

Second, knowledge about AT use (and procurement) is still not widely disseminated among professionals who work with children (Atanga et al., 2019). As seen above, it is recommended that an OT be engaged in a transdisciplinary team in order to support adequate AT provisions. But, in many countries, not only do transdisciplinary teams not exist within the education sector but, if they exist, they may not include someone knowledgeable about AT (Bodine & Melonis, 2005).

**Identifying and assessing AT needs**

The process of identification and assessment of assistive technology needs should be made by a transdisciplinary team of professionals (Bodine & Melonis, 2005) (Boger et al., 2016), that places the child and family at the center of decision-making. This team, as described above, aims to ensure professionals from various fields work together with one objective, namely to provide a child and the family with ways to overcome obstacles.

In the case of children entering (or already in) the education system, this team will likely include, in addition to the child and a parent or caregiver: the teacher the student is assigned to, a school administrator, a school psychologist, a school social worker (or the child’s case manager in the case of a child entering from an EI/EI programme), and a special education professional, and other service providers, as needed. Other professionals include (but are not limited to) a speech and language therapist, a sign language interpreter, a physical therapist, an occupational therapist, etc., as adequate to respond to the uniquely identified strengths and needs of the child. If there is a suspected need for an assistive technology, or the child already has an AT device that requires a reevaluation, a specialist in the area may also be a part of the team, such as an audiologist, a Braille specialist, an Information and Communication Technology expert, etc.

It is desirable that identification and assessment for AT takes place when disability identification and assessment are occurring. This varies by country, and may also vary by districts, municipalities or schools. However, identifying a need for AT should not be seen as a step in a process of labeling or identifying children with disabilities or special education needs but rather a necessary step in a pedagogical assessment.

Finland is an example of an inclusive system that identifies students for additional support without using diagnoses at all. Finland’s assessment system and procedures are pedagogically driven, as opposed to diagnostically driven. Educational supports exist on a continuum and intensified support measures and are initiated on the basis of a pedagogical assessment centered around the pupil’s learning progress (Braun, 2020).

Much like the process of identifying a disability, the process of providing a child with an assistive product or solution requires that a circular problem-solving process takes place, in which there is: 1) the identification of the expected outcomes; 2) identification of the AT product or solution that might best lead to the intended outcomes; 3) a period of adaptation, trial-and-error; 4) an evaluation of the success vis-à-vis the expected outcomes; 5) reconsideration of the AT product or solution (Boger et al., 2016).

**Support services for inclusion**

This paper argues that in order to advance inclusive education and fulfill both the right to accessibility and the right to inclusive education, it is imperative to adequately supply education systems with “support services for inclusion” that might be able to work, synergistically, at the intersection of both areas: education and AT (European Agency for Development in Special Needs Education, 2013). These are more commonly found in
countries with extensive experience in special education needs, and they should complement the process described above with regards to EIEI. However, due consideration should also be given to the replacement of “segregated centre-based services with inclusive community-based services, where children with disabilities are presented with the opportunity to learn with children in mainstream early childhood education and community settings” (Tamakloe, 2020).

In any case, decisions should be made by a transdisciplinary team of professionals that can effectively ensure access and participation of all children (including those with disabilities) in inclusive education (Sousa et al., 2014). However, even after the identification and assessment have taken place (and an Individualized Education Plan written and agreed upon), it is likely that an AT specialist continues to need to be involved in the education process to ensure adequacy of AT overtime. AT by itself accomplishes nothing. There has to be an expressed willingness of the user, as well as a favorable environment for the interaction to take place. In addition, a support infrastructure must exist to ensure continued use which is responsive to the needs of the child. (Witte et al., 2018). As observed in various countries – Moldova, Nepal, Paraguay – it is not uncommon for children with disabilities to be the recipients of charity AT products without the adequate support infrastructure being developed or funded. The resulting situation is that children with disabilities are, for example, fitted with a hearing aid but not shown how to change the batteries, not provided with batteries and filters, or have no access to a cadre of technicians for adequate fitting, training and servicing the devices (Hunt, 2012).

In addition, because children and youth spend so much of their time on education-related tasks, there may be a need to extend AT beyond the boundaries of the school. Assistive technology considerations, even those that are determined in the school environment by education professionals, impact the entire life of a child or youth with a disability. For example, if a student requires a device to support with communication (e.g., augmentative board) it is likely that this will also be needed at home, in the same way that a child that might need reading glasses in school, will certainly continue to need them (and certainly use them) at home. Therefore, understanding the school and home environments is key in ensuring AT is used continuously and across settings (Smith et al., 2018).

**Assistive technology as a government-wide responsibility**

Despite the demonstrated need for AT to cross environments and support children’s in various activities throughout their life, service provision traditionally occurs in silos and is not set for cross-environmental use (European Agency for Development in Special Needs Education, 2013). In some countries where AT is funded, procured and provided for by the Ministry of Education, there might be some systemic reluctance to extend the use of the product – which is regarded as education specific – beyond the normal school day, and/or outside the school walls. As a result, a child who might have access to a Tablet when in a special school to facilitate writing activities, may have to leave the Tablet in the school building after hours and on weekend (MacLachlan et al., 2018), which might impact their ability to extend their writing practice beyond the school walls. This scenario, often seen even in middle- and high-income countries (Hunt, 2019), reflects disputes across governments and between ministries with regards to the financial responsibilities toward disability-related expenses, including those associated with Information and Communication Technologies and Assistive Technologies (Deloitte & AbilityNet, 2011).

In an effort to respond to some of these issues, UNESCO in collaboration with the European Agency for Special Needs and Inclusive Education, and the G3ict have created a Model Policy for Inclusive ICTs in Education for Persons with Disabilities (2014). Developed with extensive collaboration across the field, the Model Policy assumes that “inclusive ICTs to support learners with disabilities are not only available within certain educational settings (e.g., schools); inclusive ICTs are transferable to different social, educational and lifelong learning contexts” (UNESCO, 2014, p. 22). In order to facilitate transference, the Model Policy advocates for the “identification of a Lead Ministry whose role it is to take a holistic approach and ensure the necessary links between different education, social affairs, employment and finance sector policies” (p. 17) and suggests that “The overall costs of providing inclusive ICTs for use in the home or in education or workplace situations might be shared across a number of responsible authorities and so effective, long term co-ordination and collaboration is necessary to ensure coherent funding streams” (p. 42).

**Recommendations for stakeholders**

The recommendations below are general in nature with a view to engage all interested stakeholders in education, health and social protection:

- Ensure all stakeholders in education are familiar with their national and international obligations with regards to children’s rights to education and to assistive technology; Engage Non-Governmental Organizations (NGOs) and Organizations of Persons with Disabilities (OPDs) that work on behalf of children with disabilities to provide training on children’s rights, as needed;
- Engage in meaningful and focused planning and implementation of multi-sector transdisciplinary systems of Early Identification and Early Intervention that are centered on the child and the family and take on a life-cycle approach;
- Create referral and provision systems that ensure education, health and social protection services work collectively with the goal to support children with disabilities and their families in all ways, including providing fit-for-purpose assistive technology at no cost;
- Develop a cadre of “support services for inclusion” professionals that include, among others, occupational therapists and specialists in ICT and assistive technology; these services can be itinerant, and each team serve various schools, to ensure adequate use of resources.
Disclosure statement

No potential conflict of interest was reported by the author.

References

Associação Portuguesa de Terapeutas Ocupacionais. (n.d.). Áreas de Intervenção. Retrieved October 2020, from https://www.ap-to.pt/areas-de-intervencao/

Atanga, C., Jones, B. A., Krueger, L. E., & Lu, S. (2019). Teachers of students with learning disabilities: Assistive technology knowledge, perceptions, interests, and barriers. Journal of Special Education Technology, 35(4), 236–248. https://doi.org/10.1177/0162643419864858

Boavida, T., Aguiri, C., & McWilliam, R. A. (2015). A intervenção precoce na infância e os contextos de educação de infância (Early Intervention in childhood and the education context in childhood). In S. Torres (Ed.), Teoria, Práticas e Investigação em Intervenção Precoce (pp. 6–26). CIED - Centro Interdisciplinar de Estudos Educacionais.

Bodine, C., & Melonis, M. (2005). Teaming and assistive technology in educational settings. In D. Edyburn, K. Higgins, & R. Boone (Eds.), Handbook of special education technology research and practice (pp. 209–227). Knowledge by Design, Inc.

Boger, J., Jackson, P., Mulvanny, M., Sixsmith, J., Sixsmith, A., Mihalidis, A.,… Martin, S. (2016). Principles for fostering the transdisciplinary development of assistive technology. Disability and Rehabilitation: Assistive Technology, 12(5), 480–490. https://doi.org/10.3109/17483107.2016.1151953

Borg, J., Östergren, P.-O., Larsson, S., Rahman, A. A., Bari, N., & Khan, A. N. (2012). Assistive technology use is associated with reduced capability poverty: A cross-sectional study in Bangladesh. Disability and Rehabilitation. Assistive Technology, 7(2), 112–121. https://doi.org/10.3109/17483107.2011.602173

Braun, A. M. (2020). Referral and identification of special educational needs - paper commissioned for the 2020 global education monitoring report, inclusion and education. UNESCO. Cboard. (n.d.). Cboard. Retrieved November 12, 2020, from https://www.cboard.io/

Deloitte & AbilityNet. (2011). The internal market for assistive ICT - executive summary of the final report. European Union.

Desmond, D., Layton, N., Bentley, J., Boot, F. H., Borg, J., Dhungana, B. M., & Sche. (2018). Assistive technology and people: A position paper from the first global research, innovation and education on assistive technology (GREAT) summit. Disability and Rehabilitation. Assistive Technology, 13(5), 437–444. https://doi.org/10.1080/17483107.2018.1471169

DGS - Direção Geral de Saúde & Serviço Nacional de Saúde. (n.d.). Sistema Nacional de Intervenção Precoce na Infância. Retrieved October 2020, from https://www.dgs.pt/sistema-nacional-de-intervencao-precoce-na-infancia.aspx

European Agency for Development in Special Needs Education. (2013). Organisation of provision to support inclusive education.

Hersh, M. (2020). Technology for inclusion - paper commissioned for the 2020 global education monitoring report, inclusion and education. UNESCO.

Hollenweger, J. (2018). Applying ICF in education and care. In S. Castro (Ed.), An emerging approach for education and care - implementing a worldwide classification of functioning ad disability (pp. 23–36). Routledge.

Hunt, P. F. (2012). Protecting children in Moldova from family separation, violence, abuse, neglect and exploitation - a feasibility study of the current preschool and pre-university educational system for children with hearing impairments in Moldova. Partnership for Every Child.

Hunt, P. F. (2019). Feasibility study for a child guarantee: Target group discussion paper on children with disabilities. European Commission. Inclusive Education Task Team (2020). What an inclusive, equitable, quality education means to us: Report of the international disability alliance. IDA. Geneva, Switzerland.

International Dyslexia Association. (2019). IDA Dyslexia handbook - What every family should know.

Karlsson, P., Johnston, C., & Barker, K. (2017). Influences on students’ assistive technology use at school: The views of classroom teachers, allied health professionals, students with cerebral palsy and their parents. Disability and Rehabilitation: Assistive Technology. https://doi.org/10.1080/17483107.2017.1373307

Lindeblad, E., Nilsson, S., Gustafson, S., & Svensson, I. (2017). Assistive technology as reading interventions for children with reading impairments with a one-year follow-up. Disability and Rehabilitation. Assistive Technology, 12(7), 713–724. https://doi.org/10.1080/17483107.2016.1253116

Long, T., Huang, L., Woodbridge, M., Woolverton, M., & Minkel, J. (2003). Integrating assistive technology into an outcome-driven model of service delivery. Infants and Young Children, 16(4), 272–283. https://doi.org/10.1097/00001163-200310000-00002

MacLachlan, M., McVeigh, J., Cooke, M., Ferri, D., Holloway, C., Austin, V., & Javadi, D. (2018). Intersections between systems thinking and market shaping for assistive technology: The SMART (Systems-Market for Assistive and related Technologies) thinking matrix. International Journal of Environmental Research and Public Health, 15(12), 2627. https://doi.org/10.3390/ijerph15122627

Marope, P. T., & Kaga, Y. (2015). Investigating against evidence - the global state of early childhood care and education. UNESCO Publishing.

Marrus, N., & Hall, L. (2017). Intellectual disability and language disorder. Child and Adolescent Psychiatric Clinics of North America, 26(3), 539–554. https://doi.org/10.1016/j.chc.2017.03.001

Mistrett, S. G., Lane, S. J., & Ruffino, A. G. (2005). Growing and learning through technology: Birth to five. In D. Edyburn, K. Higgins, & R. Boone (Eds.), Handbook of special education technology, research and practice (pp. 273–307). knowledge By Design.

Nelson, L. H., Poole, B., & Muñoz, K. (2013). Preschool teachers’ perception and use of hearing assistive technology in educational settings. Language, Speech, and Hearing Services in Schools, 44(3), 239–251. https://doi.org/10.1044/0161-4614(2013/12-0038)

Netheerton, D. L., & Deal, W. F. (2006). Assistive technology in the classroom. The Technology Teacher, 66, 10.

Otaiba, S., & Petcher, Y. (2020). Identifying and serving students with learning disabilities, including dyslexia, in the context of multiliteracy supports and response to intervention. Journal of Learning Disabilities, 53(5), 327–331. https://doi.org/10.1177/0022219420943691

Santos, C., & Nunes, C. (2015). Influência do iPad no desenvolvimento de crianças com NEE: Perspectivas de pais e de um terapeuta ocupacional (iPad’s influence in the development of children with SEN: A father and occupational therapist perspective). In S. Torres (Ed.), Teoria, Práticas e Investigação em Intervenção Precoce (pp. 233–262). CIED (Centro Interdisciplinar de Estudos Educacionais).

Scherer, M., & Craddock, G. (2002). Matching person & technology (MPT) assessment process. Technology and Disability, 14(3), 125–131. https://doi.org/10.3233/TAD-2002-14308

Senjaman, S. S., Foster, A., & Bascaran, C. (2020). Barriers to using assistive technology among students with visual disability in schools for the blind in Delhi, India. Disability and Rehabilitation. Assistive Technology, 16, 7. https://doi.org/10.1080/17483107.2020.1738566

Slee, R. (2018). Defining the scope of inclusive education. Paper commissioned for the 2020 Global Education Monitoring report, Inclusion and Education. UNESCO.

Smith, R. A., Scherer, M., Cooper, R., Bell, D., Hobbs, D. A., Pettersson, C.,… Bauer, S. (2018). Assistive technology products: A position paper from the first global research, innovation, and education on assistive technology (GREAT) summit. Disability and Rehabilitation, 13(5), 473–485. https://doi.org/10.1080/17483107.2018.1473895

SNIP - Sistema Nacional de Intervenção Precoce na Infância. (n.d.). Recursos. Retrieved October 2020, from https://snipi.gov.pt/recursos/no-back

Sousa, J., Mota, A., Dolgner, J., Teixeira, P., & Fabela, S. (2014). Avaliação das Políticas Públicas - Inclusão de Alunos com Necesidades Educativas Especiais: O Caso dos Centros de Recurso para a Inclusão (Evaluation of Public Policies - the inclusion of students with SEN: the case of Inclusion Resource Centres [unpublished]. Centro de Reabilitação Profissional de Gaia.
Tamakloe, D. (2020). Enhancing learning and development of young children with disabilities with assistive technology. *International Perspectives on Inclusive Education*, 14(14), 141–161. https://doi.org/10.1108/S1479-36362020000014012

UN Commission on Human Rights. (1990). *Convention on the rights of the child*. E/CN.4/RES/1990/74.

UN General Assembly. (2007, January 24). *Convention on the rights of persons with disabilities (CRPD)*, A/RES/61/106.

UN General Assembly. (2015, October 21). *Transforming our world: The 2030 agenda for sustainable development*. A/RES/70/1.

UN Statistics Division. (n.d.). SDG indicators - metadata repository. Retrieved October 2020, from https://unstats.un.org/sdgs/metadata/?Text=&Goal=4&Target=4.a

UNDESA. (Advance Unedited Version). *Realization of the sustainable development goals by, for and with persons with disabilities* - UN flagship report on disability and development 2018 - executive summary.

UNESCO. (2014). *Model policy for inclusive ICTs in education for persons with disabilities*.

UNESCO. (2020). *Global education monitoring report 2020: Inclusion and education*.

UNICEF. (2013). *The state of the world's children 2013 - children with disabilities*.

UNICEF. (n.d.a). *Accessible digital textbooks*. Retrieved November 12, 2020, from https://www.accessibletextbooksforall.org/

UNICEF. (n.d.b). *Assistive technology*. Retrieved November 12, 2020 from https://www.unicef.org/innovation/topics/assistive-technology

WHO & UNICEF. (2012). *Early childhood development and disability: A discussion paper*. World Health Organization.

WHO & UNICEF. (2015). *Assistive technology for children with disabilities: Creating opportunities for education, inclusion and participation*. World Health Organization.

Witte, L., Steel, E., Gupta, S., Ramos, V. D., & Roentgen, U. (2018). Assistive technology provision: Towards an international framework for ensuring availability and accessibility of affordable high-quality assistive technology. *Disability and Rehabilitation. Assistive Technology, 13*(5), 1–6. https://doi.org/10.1080/17483107.2018.1470264

World Bank. (2018). *World development report 2018: Learning to realize education's promise*.

World Bank. (2019). *Every learner matters: Unpacking the learning crisis for children with disabilities*.

World Health Organization & World Bank. (2011). *World report on disability 2011*. World Health Organization.

World Health Organization. (2001). *International classification of functioning, disability and health*.

World Health Organization. (2012). *Developmental difficulties in early childhood: Prevention, early identification, assessment and intervention in low- and middle-income countries - A review*. WHO.

World Health Organization. (n.d.). *Global cooperation on assistive technology*. Public health, innovation, intellectual property and trade. Retrieved October 2020, from https://www.who.int/phi/implementa tion/assistive_technology/phi_gate/en/