Department for Education

Assistive Technology

Stakeholder report: Developers

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Contents

Executive Summary

Assistive technologies (AT) are specialised products designed for people with special educational needs and disabilities. This stakeholder report describes the findings of the rapid literature review relevant for developers of assistive technology and educational technology products.

Additional stakeholder reports for administrators, educators, policymakers, and researchers can be found at https://www.knowledge-by-design.com/ukat/

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Introduction

1 The Department for Education's Education Technology Strategy, Realising the Potential for Technology in Education, described 10 EdTech Challenges designed to catalyse activity in specific areas of the EdTech sector in ways that are aligned to the needs of teachers and students. One of these challenges focuses on needing to identify the best technology that helps level the playing field for learners with Special Educational Needs and Difficulties (SEND).

Learn More

Department for Education. (2019). Realising the Potential for Technology in Education. https://www.gov.uk/government/publications/realising-the-potential-of-technology-in-education

2 In order to meet this challenge it is necessary to understand the current landscape of assistive technology (AT) used in education and what impact they have on outcomes for students with special educational needs and disabilities (SEND). To this end, a rapid review of the literature on assistive technology (AT) in education was conducted over a ten-week period in February – April 2020. A final report from the project describing the findings is available for download.

Learn More

Rapid Literature Review on Assistive Technology in Education
http://www.knowledge-by-design.com/ukat/

3 The purpose of this stakeholder report is to provide administrators with insights about the use of AT in educational settings in order to facilitate the effective delivery of AT devices and services for pupils and learners with special educational needs and disabilities. Interested readers are encouraged to visit the project web site to query the interactive data set or contact the Principal Investigator with questions or requests for custom searches of the knowledge base.

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What is Assistive Technology (AT)?

4 The World Health Organization describes AT as follows:

- Assistive technology is an umbrella term covering the systems and services related to the delivery of assistive products and services.
- Assistive products maintain or improve an individual's functioning and independence, thereby promoting their well-being.
- Assistive technology enables people to live healthy, productive, independent, and dignified lives, and to participate in education, the labour market and civic life. Assistive technology reduces the need for formal health and support services, long-term care and the work of caregivers. Without assistive technology, people are often excluded, isolated, and locked into poverty, thereby increasing the impact of disease and disability on a person, their family, and society.

Learn More

World Health Organization. (2018, May 18). Assistive technology.
https://www.who.int/news-room/fact-sheets/detail/assistive-technology

5 Over a lifetime, each of us will experience situations in which we personally, or, someone we know, will encounter limitations due to aging, disease, accident, or disability, that will impact the ability to perform basic life functions such as hearing, seeing, self-care, mobility, working, and participating in education. Whereas some of us may be born with a disability or disease that will require us to overcome limitations throughout our life, others will need to learn how to respond to challenges that arise from an accident or limitations that arise from simply growing older. As a result, AT has the potential to impact everyone, either directly as a personal user of AT, or indirectly, as a means of helping someone we know.

6 Realising the potential of technology in education involves maximising the application of assistive technologies to enhance academic, behavioral, social, and economic benefits

of pupils and students with special educational needs and difficulties. Historically, pupils and students with special educational needs and disabilities have had difficulty accessing the general education curriculum. This means they have been unable to achieve the same benefits from instruction as their peers.

7 The essence of assistive technology involves finding appropriate tools that enhance the functional performance of a person with a disability to complete routine tasks that are difficult or impossible. The magnitude of this task is not insignificant as there are over 25,000 assistive technology devices. When a person finds the appropriate AT, they are able to complete tasks that they previously could not complete, did slowly, or did poorly. The right AT augments, bypasses, or compensates for a disability.

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AbleData
https://abledata.acl.gov/

8 The design, marketing, and use of assistive technology must be understood in the context of technology used in schools and can be illustrated as a series of concentrice circles. In the outer circle – technology in society. In the middle circle – educational technolog. And the inner circle – assistive technology.

9 Developers may wish to learn more about policy initiatives in the educational sector in order to understand policy priorities, opportunities, and challenges associated with scaling the benefits of educational and assistive technologies.

Learn More

Maryland State Department of Education. (2011). *A route for every learner: Universal design for learning (UDL) as a framework for supporting learning and improving achievement for all learners in Maryland, prekindergarten through higher education*. Baltimore, MD: Author.

McAlvage, K., & Rice, M. (2018). *Access and accessibility in online learning: Issues in higher education and K-12 contexts*. Newburyport, MA: Online Learning Consortium for Research for Digital Learning and Leadership.

Learn More (continued)

McLaren, R. (2018). *Accessible virtual learning environments: Making the most of the new regulations*. Retrieved from https://www.policyconnect.org.uk/research/accessible-virtual-learning-environments-making-most-new-regulations

Naylor, R., & Mifsud, N. (2019). *Structural inequality in higher education: Creating institutional cultures that enable all students*. Unpublished study. Retrieved February 19, 2020 from http://www.ncsehe.edu.au/wp-content/uploads/2019/09/NaylorMifsud-FINAL.pdf

Office of Educational Technology. (2017). *Reimagine the role of technology in education: 2017 national education technology plan update*. Washington, DC: U.S. Department of Education.

10 A specific technology may or may not be labeled as AT since the function of all technology is to serve the user as a tool. Second, since many pupils and students with special educational needs and disabilities are served in inclusive classrooms, it is necessary to understand the general technologies they may encounter in these environments. Finally, since mainstream technologies increasingly incorporate universal design for learning (UDL) principles into product design, some functions that formerly required specialised assistive technology can now be found in off-the-shelf products such as laptop, tablet, and smartphone operating systems and web browsers.

Learn More

Gronseth, S. (2018). Inclusive design for online and blended courses: Connecting web content accessibility guidelines and universal design for learning. *Educational Renaissance, 7*, 14-22.

Kim, H. N. (2018). User experience of mainstream and assistive technologies for people with visual impairments. *Technology and Disability, 30*(3), 127-133.

Macomber, P.T. (2014). Real-life success: Bridging the gap between general education and special education: The imPACT of universal design for learning. *Closing the Gap, 33*(2), 23-27.

Navarrete, R., & Luján-Mora, S. (2018). Bridging the accessibility gap in open educational resources. U*niversal Access in the Information Society, 17*(4), 755-774.

Learn More (continued)

Rice, M. F. (2018). Supporting literacy with accessibility: Virtual school course designers' planning for students with disabilities. *Online Learning, 22*(4), 161-179.

Sokolik, M. (2018). The nexus of accessibility and pedagogy: What every online instructional designer should know. *TESL-EJ, 21*(4), 1-13.

11 Many developers have sought to create new products in accordance with principles associated with universal usability. Designers have sought to understand the specialised needs of individuals with disabilities in order to design products that are "usable by the widest range of people operating in the widest range of situations as is commercially practical" (Vanderheiden, 2000). This design philosophy, known as universal design, has significantly impacted mainstream technologies as accessibility features are built into a product and made available to everyone. This approach to design and development has the potential to enhance the market size for a product.

Learn More

IMS Global Learning Consortium. (2019). IMS Global AccessforAll (AfA) Primer. Retrieved from http://www.imsglobal.org/activity/ accessibility

Vanderheiden, G.C. (2000, November). Fundamental principles and priority setting for universal usability. In *Proceedings of the 2000 Conference on Universal Usability* (pp. 32-37). Washington, DC: ACM. http://www.acm.org/pubs/articles/proceedings/chi/355460/p32-vanderheiden/p32-vanderheiden.pdf

Wilford, S. H. (2019). Responsible research and innovation: Using the requirements tool for stakeholder engagement in developing a universal design for learning guidelines for practice. *Sustainability, 11*(10), 1-16. doi:10.3390/su11102963

12 The ability to access and use AT is essential, but not sufficient, for closing the achievement gap experienced by pupils and students with special educational needs and disabilities. This insight has prompted considerable attention to the nature of inaccessible curricula. Historically, the problem was a textbook with its rigid fixed format. The evolution of digital learning materials, as well as the wealth of information available – or inaccessible – via the World Wide Web, has helped educators appreciate the value and flexibility of digital text (e.g., change the font, size, copy, paste, summarise, convert from

text to speech) for diverse learners. Advocacy for accessible educational materials (AEM) is a necessary component of AT devices and service systems.

Learn More

Advisory Commission on Accessible Instructional Materials in Postsecondary Education for Students with Disabilities. (2011). *Report of the advisory commission on accessible instructional materials in postsecondary education for students with disabilities*. Washington, DC: U.S. Department of Education.

Fletcher, G., Levin, G., Lipper, K., & Leichty, R. (2014). The accessibility of learning content for all students, including students with disabilities, must be addressed in the shift to digital instructional materials. *SETDA Policy Brief.* Glen Burnie, MD: State Educational Technology Directors Association.

Fox, C., & Jones, R. (2018). *Navigating the digital shift 2019: Equitable opportunities for all learners*. Glen Burnie, MD: State Educational Technology Directors Association.

Martin, N., Wray, M., James, A., Draffan, E. A., Krupa, J., & Turner, P. (2019). *Implementing inclusive teaching and learning in UK higher education – Utilising universal design for learning (UDL) as a route to excellence*. Society for Research into Higher Education. Retrieved from https://openresearch.lsbu.ac.uk/item/8666q

Wiazowski, J. (2010). (In)accessible digital textbooks. C*losing the Gap, 29*(3), 17-22.

Special Educational Needs

13 Disabilities manifest themselves in many different forms and severities. As of January 2019, 1.3 million (14.9%) of all pupils in England have special education needs.

Learn More

Special Educational Needs in England: January 2019https://www.gov.uk/government/statistics/special-educational-needs-in-england-january-2019

14 Whereas the impact of a disability should always be considered on an individual basis, there are general domains of functioning that are affected by a disability (see Table below). Developers interested in a specific disability category are encouraged to

focus on a particular row to understand the relevant applications of AT. Developers interested in a specific domain of functioning relative to AT are encourage to explore the table columns to understand the various groups that may benefit.

Table 1 Relevant Domains of Potential AT Application by Disability

	Domains					
Disability	access	behavior/social	communication	independence	learning	mobility
autism spectrum disorder	•	•	•	•	•	
deafness	•		•	•	•	•
deaf-blindness	•		•	•	•	•
emotional and behavioral disorders		•			•	
hearing impairment	•			•	•	
intellectual disability	•	•	•	•	•	•
orthopedic impairments	•			•	•	•
specific learning disability	•			•	•	
speech language or communication	•	•	•	•	•	•
traumatic brain injury	•		•	•	•	•
visual impairment	•		•	•	•	•

AT Systems

15 The value and significance of assistive technology can be understood in relation to performance problems. That is, a person with a disability encounters a task they are unable to successfully complete. Following the identification of an appropriate assistive technology device, acquisition of the product, training and support in its use, a person is subsequently able to complete the same task that was previously difficult or impossible. As a result, assistive technology devices and services enhance the performance of individuals with disabilities by enabling them to complete tasks more effectively, efficiently, and independently than otherwise possible.

Learn More

Andrich, R., Norman, G., Mavrou, K., Roentgen, U., Daniels, R., Desideri, L., ... & de Witte, L. (2019). Towards a global quality framework for assistive technology service delivery. In N. Layton, & J. Borg, (Eds.), *Global perspectives on assistive technology: Proceedings of the GReAT Consultation 2019, Volume 2* (pp. 263-269). Geneva, Switzerland: World Health Organization.

Malcolm, M. P., & Roll, M. C. (2017). The impact of assistive technology services in post-secondary education for students with disabilities: Intervention outcomes, use-profiles, and user-experiences. *Assistive Technology, 29*(2), 91-98.

Negrea, S. (2019). Tech-ommodations: Digital-age disability services: Models for managing assistive technology through partnerships between disability services and IT. *University Business*, November/December, 39-41.

Reed, P., Kaplan, M., & Bowser, G. (2009). *The assistive technology trainer's handbook*. Roseburg, OR: National Assistive Technology in Education Network.

Zapf, S. A., Scherer, M. J., Baxter, M. F., & Rintala, D.H. (2016). Validating a measure to assess factors that affect assistive technology use by students with disabilities in elementary and secondary education. *Disability and Rehabilitation: Assistive Technology, 11*(1), 38-49.

16 Developers seeking to create AT products that will be used in schools are encouraged to learn about how AT services are provided in schools in order to understand key personnel roles, responsibilities, and systems.

Learn More

Bausch, M. E., Ault, M. J., & Hasselbring, T. S. (2015). Assistive technology in schools: Lessons learned from the National Assistive Technology Research Institute. In D.L. Edyburn, (Ed.), *Advances in Special Education Technology - Volume 1: Efficacy of Assistive Technology Interventions,* (pp. 13-50). Bingley, United Kingdom: Emerald Group Publishing.

Davis, T. N., Barnard-Brak, L., & Arredondo, P. L. (2013). Assistive technology: Decision-making practices in public schools. *Rural Special Education Quarterly, 32*(4), 15-23.

Elsaesser, L. J., & Bauer, S. (2012). Integrating medical, assistive, and universal design products and technologies: Assistive Technology Service Method (ATSM). *Disability and Rehabilitation: Assistive Technology, 7*(4), 282-286.

Hoogerwerf, E., Solander-Gross, A., Mavrou, K., Traina, I, & Hersch, M. (2017). A self-assessment framework for inclusive schools supporting assistive technology users. *Studies in Health Technology and Informatics, 242*, 820-827.

17 Assistive technology developers often find it useful to understand the procurement processes used by schools. This issue is increasingly important as product accessibility is a consideration during the procurement process. Similarly, developers may need to be aware of the specialised sources of AT funding systems in order to assist their customers in navigating the procedures required to obtain funding from third-party payers.

Learn More

Clayback, D., Hostak, R., Leahy, J. A., Minkel, J., Piper, M., Smith, R. O., & Vaarwerk, T. (2015). Standards for assistive technology funding: What are the right criteria. *Assistive Technology Outcomes and Benefits, 9*(1), 40-55.

Durocher, E., Wang, R. H., Bickenbach, J., Schreiber, D., & Wilson, M. G. (2019). “Just access”? Questions of equity in access and funding for assistive technology. *Ethics & Behavior, 29*(3), 172-191.

Layton, N., Hubbard, W., Burton, J., & Kuna, A. (2016). Quality, choice and outcomes in assistive technology (AT) equipment funding schemes: A procurement case study. *Health Systems and Policy Research, 3*(1), 1-8.

Learn More (continued)

Mulcahy, B. (2017). Funding advocacy 101: Speech generating devices and medicaid. *Closing the Gap, 36*(5), 36-38.

Steel, E. J., Layton, N. A., Foster, M. M., & Bennett, S. (2014). Challenges of user-centred assistive technology provision in Australia: Shopping without a prescription. *Disability and Rehabilitation: Assistive Technology, 11*(3), 235-240.

Wallace, J. (2011). Assistive technology funding in the United States. *NeuroRehabilitation, 28*(3), 295-302.

Whetstone, K. W. (2017). Upholding accessibility standards when selecting tech tools. Paper presented at the Annual Meeting of the Association Supporting Computer Users in Education (ASCUE), Myrtle Beach, SC, June 11-15.

Develop a Design Strategy

18 It is difficult to estimate the size of the AT market in Australia, Canada, United Kingdom, or the United States. However, one study found that the European AT market is over $30 billion Euros. The AT market is considered a subset of the educational technology market and the rehabilitation technology market. Developers interested in commercialising their AT products are advised to develop a business plan that reflects the mainstream or niche market they are seeking to enter. Low incidence disabilities have a very small market that can result in limited revenues and margins. Consider the value of forging partnerships to facilitate the research and development process.

Learn More

Buhler, C., & Barbera, R. (2011). Assistive technology industry: A field for cooperation and networking. *Technology and Disability, 23*(3), 115-130.

Fineberg, A. E., Savage, M., Austinc, V., Boiten, S., Droop, J., Allen, M., ... & Mitra, G. (2019). ATscale - Establishing a cross-sector partnership to increase access to assistive technology. In N. Layton, & J. Borg, (Eds.), *Global perspectives on assistive technology: Proceedings of the GReAT Consultation 2019, Volume 2* (pp. 428-439). Geneva, Switzerland: World Health Organization.

Learn More (continued)

Mulfari, D., Celesti, A., Villari, M., & Puliafito, A. (2015). Providing assistive technology applications as a service through cloud computing. *Assistive Technology, 27*(1), 44-51.

Nobrega, A. R., Lane, J. P., Flagg, J. L., Stone, V. I., Lockett, M., Oddo, C., ... & Usiak, D. J. (2015). Assessing the roles of national organizations in research-based knowledge creation, engagement and translation: Comparative results across three assistive technology application areas. *Assistive Technology Outcomes and Benefits, 9(*1), 54-97.

19 Review the literature to understand about existing AT products, unmet needs, trends and issues, efficacy, and more.

Learn More

Bhowmick, A., & Hazarika, S. M. (2017). An insight into assistive technology for the visually impaired and blind people: State-of-the-art and future trends. *Journal on Multimodal User Interfaces, 11*(2), 149-172.

Csapo, A., Wersenyi, G., Nagy, H., & Stockman, T. (2015). A survey of assistive technologies and applications for blind users on mobile platforms: A review and foundation for research. *Journal on Multimodal User Interfaces, 9*(4), 275-286.

Kim, J. S., & Kim, C. H. (2014). A review of assistive listening device and digital wireless technology for hearing instruments. *Korean Journal of Audiology, 18*(3), 105-111.

Koester, H. H., & Arthanat, S. (2018a). Text entry rate of access interfaces used by people with physical disabilities: A systematic review. *Assistive Technology, 30*(3), 151-163.

Lobo, M. A., Hall, M. L., Greenspan, B., Rohloff, P., Prosser, L. A., & Smith, B. A. (2019). Wearables for pediatric rehabilitation: How to optimally design and use products to meet the needs of users. *Physical therapy, 99*(6), 647-657.

Morris, J., Thompson, N., Lippincott, B., & Lawrence, M. (2019). Accessibility user research collective: Engaging consumers in ongoing technology evaluation. *Assistive Technology Outcomes and Benefits, 13*, 38-56.

Learn More (continued)

Ok, M. W., Rao, K., Bryant, B. R., & McDougall, D. (2017). Universal design for learning in pre-k to grade 12 classrooms: A systematic review of research. *Exceptionality, 25*(2), 116-138.

20 In order to produce AT products that meet the needs of people with special needs and disabilities, best practice indicates that it is essential to involve potential users in the iterative design process. It is not appropriate to test AT products on able-bodied people asking them to simulate a disability. Increasingly, children are being engaged in the design of new technologies.

Learn More

Allsop, M., Gallagher, J., Holt, R., Bhakta, B., & Wilkie, R. (2011). Involving children in the development of assistive technology devices. *Disability and Rehabilitation: Assistive Technology, 6*(2), 148-156.

Francis, P., Mellor, D., & Firth, L. (2009). Techniques and recommendations for the inclusion of users with autism in the design of assistive technologies. *Assistive Technology, 21*(2), 57-68.

Hobbs, D., Walker, S., Layton, N., & Hobbs, D. (2019). Appropriate assistive technology co-design: From problem identification through to device commercialisation. In N. Layton, & J. Borg, (Eds.), *Global perspectives on assistive technology: Proceedings of the GReAT Consultation 2019, Volume 2* (pp. 342-358). Geneva, Switzerland: World Health Organization.

Light, J., Page, R., Curran, J., & Pitkin, L. (2007). Children's ideas for the design of AAC assistive technologies for young children with complex communication needs. *Augmentative and Alternative Communication, 23*(4), 274-287.

Williamson, T., Kenney, L., Barker, A. T., Cooper, G., Good, T., Healey, J., ... & Ryan, J. (2015). Enhancing public involvement in assistive technology design research. *Disability and Rehabilitation: Assistive Technology, 10*(3), 258-265.

21 Explore the in-depth knowledge and expertise you may need if your design and development work will focus on the unique needs of a specific disability rather than a design for all approach.

Learn More

Koester, H. H., & Arthanat, S. (2018b). The design, conduct, and reporting of research on text entry with alternative access interfaces: Recommendations from a systematic review. *Technology and Disability, 30*(3), 83-95.

McCarthy, J., McCarthy, J., Light, J., Drager, K., McNaughton, D., Grodzicki, L., ... & Parkin, E. (2006). Re-designing scanning to reduce learning demands: The performance of typically developing 2-year-olds. *Augmentative and Alternative Communication, 22*(4), 269-283.

Stock, S. E., Davies, D. K., & Wehmeyer, M. L. (2010). Design and evaluation of a computer-animated simulation approach to support vocational social skills training for students and adults with intellectual disabilities. *Assistive Technology Outcomes and Benefits, 6*(2), 43-56.

Traina, I., & Hoogerwerf, E. J. (2018). A possible framework for the design of learning programs in assistive technology for people with intellectual disabilities in inclusive educational environments. *Psychology and Behavioral Sciences, 7*(2), 29-37.

22 Explore the methodologies associated with design research as an approach to agile development while simultaneously collecting user data about the need and function of the new product. Such data can be used as a case study for customers interested in efficacy data as you bring your product to market.

Learn More

Creer, S., Cunningham, S., Green, P., & Yamagishi, J. (2013). Building personalised synthetic voices for individuals with severe speech impairment. *Computer Speech & Language, 27*(6), 1178-1193.

Geist, L. A. (2010). The design and development of CollaborAT: A groupware solution for IEP teams supporting school-age students who use assistive technology (Doctoral dissertation). Available from *ProQuest Dissertations & Theses Global database*. (UMI No. 3397203)

Huo, X. (2011). Tongue drive: A wireless tongue-operated assistive technology for people with severe disabilities (Doctoral dissertation). Available from *ProQuest Dissertations & Theses Global database*. (UMI No. 3535880)

Jiam, N. T., Hoon, A. H., Hostetter, C. F., & Khare, M. M. (2017). IIAM (important information about me): A patient portability profile app for adults, children and families with neurodevelopmental disabilities. *Disability and Rehabilitation: Assistive Technology, 12*(6), 599-604.

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