

# References and links for understanding the use of technology in education, especially in deprived contexts

Tim Unwin

This list of references and links is derived from more than 400 that were included in a report to UNICEF in 2018 entitled *The Future of ICTs for Education: Implications for UNICEF*. All references to internal UNICEF documents have been removed, but to give the list some coherence the material has been grouped under the broad headings of each chapter of the report.

It is made available here to help researchers and others interested in the use of technology in education, mainly in economically poorer and deprived contexts, to gain a balanced view of both the positive and the negative aspects of their use. The list is clearly only a very partial account of the hundreds of thousands of case studies, reports and academic papers that have been published in the field, but it is shared here in the hope that it will encourage those interested in the field to at least make a start at reading this wide corpus of material, and not make the mistakes that so many of us have already made in trying to implement technological solutions to educational challenges over the last quarter of a century,

## 1. Introduction: establishing the context

- <sup>1</sup><https://www.unicef.org/education/>, accessed 9<sup>th</sup> January 2018.
- <sup>1</sup> Concept Note: A UNICEF Strategy for Education 2018-2030 (internal UNICEF document).
- <sup>1</sup> UNICEF (2017) *UNICEF Strategic Plan, 2018-2021: Informal Briefing to the Executive Board*, August 2017; UNICEF (2017) *Final results framework of the UNICEF Strategic Plan, 2018-2021*, E/ICEF/2017/18
- <sup>1</sup> For a wider discussion of some of the implications around safety and security see Byrne, J. (2017) UNICEF policy guide on children and digital connectivity
- <sup>1</sup> See also UNICEF (2017) *Theory of Change Paper, UNICEF Strategic Plan, 2018-2021 realizing the rights of every child, especially the most disadvantaged*, UNICEF/2017/EB/11
- <sup>1</sup> UNICEF (2017) *State of the World's Children: Children in a Digital World*, <https://www.unicef.org/sowc2017/>, accessed 9<sup>th</sup> January 2018.
- <sup>1</sup> <https://www.unicef.org/where-we-work>, accessed 13 January 2018.
- <sup>1</sup> UNICEF (2017) *UNICEF Strategic Plan, 2018-2021: Informal Briefing to the Executive Board*, August 2017
- <sup>1</sup> Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- <sup>1</sup> UNICEF. The Convention on the Rights of the Child. Guiding principles: general requirement for all rights,

[https://www.unicef.org/crc/files/Guiding\\_Principles.pdf](https://www.unicef.org/crc/files/Guiding_Principles.pdf), accessed 9<sup>th</sup> January 2018.

- 1 Unwin, T., Weber, M., Brugha, M. and Hollow, D. (2017) *The Future of Learning and Technology in Deprived Contexts*, London: Save the Children International, <https://resourcecentre.savethechildren.net/library/future-learning-and-technology-deprived-contexts>, accessed 30<sup>th</sup> January 2018.
- 1 Jigsaw Consult (2017) *DFID: Mapping education technology*, <https://jigsawconsult.com/case/dfid-mapping-education-technology>, accessed 9<sup>th</sup> January 2018.
- 1 World Bank (2018) *World Development Report: Learning to Realize Education's Promise*, Washington DC: World Bank.
- 1 Freire, P. (1968) *Pedagogia do Oprimido*, São Paulo: Paz e Terra.
- 1 Mandela, N. (2003) Speech delivered at launch of Mindset Network, July 16, 2003, [http://db.nelsonmandela.org/speeches/pub\\_view.asp?pg=item&ItemID=NMS909&txtstr=education%20is%20the%20most%20powerful](http://db.nelsonmandela.org/speeches/pub_view.asp?pg=item&ItemID=NMS909&txtstr=education%20is%20the%20most%20powerful), accessed 15<sup>th</sup> January 2018.
- 1 <http://www.p21.org/>, accessed 26<sup>th</sup> January 2018.
- 1 Schleicher, A. The case for 21<sup>st</sup>-century learning, <http://www.oecd.org/general/thecasefor21st-centurylearning.htm>, accessed 26<sup>th</sup> January 2018; see also CERI (2008) *21<sup>st</sup> century learning: research, innovation and policy. Directions from recent OECD analyses*, Paris: OECD, <http://www.oecd.org/site/educeri21st/40554299.pdf>, accessed 26<sup>th</sup> January 2018. From 2018 the OECD PISA tests will also include a new global competence test – OECD (2017) *Preparing our Youth for an Inclusive and Sustainable world: The OECD PISA Global Competence Framework*, Paris; OECD, <https://www.oecd.org/education/Global-competency-for-an-inclusive-world.pdf>, accessed 26<sup>th</sup> January 2018.
- 1 See, for example, Rotherham, A.J. and Willingham, D.T. (2010) “21<sup>st</sup> Century” skills: not new, but a worthy challenge, *American Educator*, Spring, 17-20. <https://www.aft.org/sites/default/files/periodicals/RotherhamWillingham.pdf>, accessed 26<sup>th</sup> January 2018; see also Neelen, M. and Kirschner, P.A. (2016) 21<sup>st</sup> century skills don't exist. SO why do we need them? <https://3starlearningexperiences.wordpress.com/2016/11/01/21st-century-skills-dont-exist-so-why-do-we-need-them/>, accessed 28<sup>th</sup> January 2018.
- 1 Brooks, R., Fuller, A. and Waters, J. (eds) *Changing Spaces of Education: New Perspectives on the Nature of Learning*, Abingdon: Routledge, 2012.
- 1 World Bank (2018) *World Development Report: Learning to Realize Education's Promise*, Washington DC: IBRD/World Bank, p.3.
- 1 UNICEF (2017) *State of the World's Children 2017: Children in a Digital World*, New York: UNICEF
- 1 Unwin, T. (2016) Against “EdTech”, <https://unwin.wordpress.com/2016/09/07/against-edtech/>, accessed 15<sup>th</sup> January 2018.
- 1 AECT, <http://aect.site-ym.com/>, accessed 15<sup>th</sup> January 2018.
- 1 See also Robinson, R., Molenda, N and Rezabek, L. (2008) Facilitating learning, in Januszewski, A. and Molenda, M. (eds) *Educational Technology: A Definition with Commentary*, New York: Routledge, sponsored by AECT, 15-48.

- 1 UNICEF (n.d.) The Right to Education, <https://www.unicef.org.uk/rights-respecting-schools/the-right-to-education/>, accessed 15<sup>th</sup> January 2018.
- 1 EdTechXGlobal (2016) Global report predicts EdTech spend to reach \$252 bn by 2020, Cision PR newswire, <https://www.prnewswire.com/news-releases/global-report-predicts-edtech-spend-to-reach-252bn-by-2020-580765301.html>, accessed 26<sup>th</sup> January 2018.
- 1 EdTechXGlobal (2016) Global report predicts EdTech spend to reach \$252 bn by 2020, Cision PR newswire, <https://www.prnewswire.com/news-releases/global-report-predicts-edtech-spend-to-reach-252bn-by-2020-580765301.html>, accessed 26<sup>th</sup> January 2018.
- 1 Docebo (2016) elearning market trends and forecast 2017-2021, <https://www.docebo.com/resource/elearning-market-trends-and-forecast-2017-2021?QUORA>, accessed 26<sup>th</sup> January 2018.
- 1 <https://www.microsoft.com/en-gb/education/products/office/default.aspx>, accessed 15<sup>th</sup> January 2018.
- 1 <https://news.microsoft.com/en-au/2010/10/19/microsoftidentifies/>, accessed 8<sup>th</sup> February 2018.
- 1 jp.ik showcases Popup School solution in Africa, <https://www.jpik.com/en/newsdetail/14911280/>, accessed 28<sup>th</sup> January 2018.
- 1 Unwin, T. (ed.) (2009) *Information and Communication Technologies for Development*, Cambridge: Cambridge University Press; Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- 1 <https://www.fsf.org>, accessed 15<sup>th</sup> January 2018.
- 1 <https://opensource.org>, accessed 15<sup>th</sup> January 2018.
- 1 <https://creativecommons.org/licenses/>, accessed 15<sup>th</sup> January 2018.
- 1 Jamni, M., Kinshuk and Khribi, M.K. (eds) *Open Education: from OERs to MOOCs*, Berlin: Springer; Miao, F., Mishra, S. and McGreal, R. (eds) (2016) *Open Educational Resources: Policy, Costs and Transformation*, Paris and Burnaby: UNESCO and COL.
- 1 Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press, 53-56.
- 1 UNESC) (2015) *Education for All 2000-2015: achievements and challenges*, Paris: UNESCO.
- 1 Gem Report (2016) Can Africa afford free education? World Education Blog, <https://gemreportunesco.wordpress.com/2016/01/27/can-africa-afford-free-education/>, accessed 25<sup>th</sup> January 2018.
- 1 Results for Development and International Education Partners (2016) *Global Book Fund Feasibility Study: Final Report*, Washington DC: Results for Development and International Education Partners. This provides fascinating modelling comparisons between the costs of books and similar content delivered through ICTs.
- 1 UNICEF, convention on the Rights of the Child: early childhood education, [https://www.unicef.org/crc/index\\_73893.html](https://www.unicef.org/crc/index_73893.html), accessed 15<sup>th</sup> January 2018.
- 1 VI. Conclusions and recommendations, Report of the Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression, Frank La Rue, Human Rights Council, Seventeenth session Agenda item 3, United Nations General Assembly, 16 May 2011,

[http://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27\\_en.pdf](http://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27_en.pdf), accessed 15<sup>th</sup> January 2018

- <sup>1</sup> Unwin, T. (2014) Prolegomena on Human Rights and Responsibilities, <https://unwin.wordpress.com/2014/09/01/prolegomena-on-human-rights-and-responsibilities/>, accessed 15<sup>th</sup> January 2018.
- <sup>1</sup> Geldof, M., Grimshaw, D., Kleine, D. and Unwin, T. (2011) What are the key lessons for ICT4D partnerships for poverty reduction? Systematic review report, London: Department for International Development, [http://r4d.dfid.gov.uk/PDF/Outputs/SystematicReviews/DFID\\_ICT\\_SR\\_Final\\_Report\\_r5.pdf](http://r4d.dfid.gov.uk/PDF/Outputs/SystematicReviews/DFID_ICT_SR_Final_Report_r5.pdf); Unwin, T. and Wong, A. (2012) *Global Education Initiative: Retrospective on Partnerships for Education Development 2003-2011*, Geneva: World Economic Forum. [http://www3.weforum.org/docs/WEF\\_GEI\\_PartnershipsEducationDevelopment\\_Report\\_2012.pdf](http://www3.weforum.org/docs/WEF_GEI_PartnershipsEducationDevelopment_Report_2012.pdf) , accessed 15<sup>th</sup> January 2018.
- <sup>1</sup> See for example Farrell, G., Isaacs, S. and Trucano, M. (2007) *The NEPAD e-Schools Demonstration Project: a Work in Progress*, Washington: infoDev/The World Bank, [http://www.infodev.org/infodev-files/resource/InfodevDocuments\\_355.pdf](http://www.infodev.org/infodev-files/resource/InfodevDocuments_355.pdf), accessed 15<sup>th</sup> January 2018
- <sup>1</sup> Unwin, T. (2005) *Partnerships in Development Practice: Evidence from Multi-Stakeholder ICT4D Partnership Practice in Africa*, Paris: UNESCO, <http://unesdoc.unesco.org/images/0014/001429/142982E.pdf>, accessed 15<sup>th</sup> January 2018; Unwin, T. (2015) Multistakeholder partnerships, in: Mansell, R. and Ang, P.H. (eds) *The International Encyclopedia of Digital Communication and Society*, Chichester: John Wiley, pp.634-44. For a somewhat different perspective on PPPs, see Verger, A. and Moschetti, M. (2017) Public-Private Partnerships as an education policy approach: multiple meanings, risks and challenges, Paris: UNESCO, Education Research and Foresight Working Papers, <http://unesdoc.unesco.org/images/0024/002473/247327e.pdf>, accessed 16<sup>th</sup> January 2018.

## 2. The evidence: how we know what we know, the promises of ICTs for education, and the challenges of implementation

- <sup>1</sup> See for example, UNICEF (2011) *Non-state Providers and Public-Private Partnerships in Education for the Poor*, New York: UNICEF, [https://www.unicef.org/eapro/Final\\_NSP\\_lowres.pdf](https://www.unicef.org/eapro/Final_NSP_lowres.pdf), accessed 15<sup>th</sup> January 2018. The recent UNICEF/AKF/IU (2017) *The Opportunities and Challenges of edtech* (Draft) publication also makes extensive use of the term PPPs.
- <sup>1</sup> UNICEF (2017) *State of the World's Children 2017: Children in a Digital World*, New York: UNICEF.

### 2.1 Interpreting the evidence

- <sup>1</sup> For a meta-review of some 401 studies, see Jigsaw Consult (2017) *DFID: Mapping education technology*, <https://jigsawconsult.com/case/dfid-mapping->

[education-technology](#), accessed 9<sup>th</sup> January 2018. This lists many other reviews, and is the best source of current information about the research that has been done. Nevertheless, it too remains only partial.

- 1 The relatively new *1 World Connected* initiative is usefully seeking to provide overviews of existing ICT for development case studies, including educational ones, but tends to rely mainly on collating existing evidence, which can be of variable quality for the reasons outlined in the remainder of this section <http://1worldconnected.org/>, accessed 3<sup>rd</sup> March 2018.
- 1 A recent useful guide on simple methods for gaining useful evidence about school improvement is: Nigale, A., Seile, M. and Strods, J. (2018) *Evidence-driven school improvement: a guide for using non-academic data for education policymakers and school leaders*, London: Edurio. See also <https://edurio.com/>, accessed 29<sup>th</sup> January 2018.
- 1 The OECD PISA surveys, for example, are some of the most detailed, longitudinal surveys available, but they are only based on surveys of 15 year olds that have been undertaken in a selection of participating countries on a triennial basis since 2000, (when 43 countries were involved; 71 countries participated in the 2015 cycle) <http://www.oecd.org/pisa/aboutpisa/>, accessed 25<sup>th</sup> January 2018.
- 1 See Koczev, M., Hansen, N., Hollow, D. and Pischetola, M. (2010) *Innovative learning in Ethiopia*, Working paper, University of Groningen [https://www.rug.nl/staff/n.hansen/kocsevhansenhollowpischetola\\_2009\\_innovative\\_learning\\_in\\_ethiopia.pdf](https://www.rug.nl/staff/n.hansen/kocsevhansenhollowpischetola_2009_innovative_learning_in_ethiopia.pdf), accessed 14/1/18; Ethiopian Review (2009) Study criticises laptops for children scheme, Ethiopian Review, <http://ethiopianreview.com/content/13766> , accessed 14/1/18; Ozler, B. (2012) One Laptop per Child is not improving reading or math. But are we learning enough from these evaluations? *World Bank Development Impact Blog*, <https://blogs.worldbank.org/impactevaluations/one-laptop-per-child-is-not-improving-reading-or-math-but-are-we-learning-enough-from-these-evaluati> , accessed 14/1/18 (particularly in the comments section); Hollow, D. (2008)
- Low-cost laptops for Education in Ethiopia: Summary of Addis Ababa Implementation Report, September – December 2007, <http://www.gg.rhul.ac.uk/ict4d/workingpapers/Hollowlaptops.pdf>, accessed 16<sup>th</sup> January 2018.
- 1 UNICEF (2017) *State of the World's Children 2017: Children in a Digital World*, New York: UNICEF provides a good overview from the perspective of UNICEF.
- 1 For a range of reviews on methodological issues in research on technology and education, see Francisco, A., Epstein, B., Counselman, G., Stevens, K., Chou, L., Charania, M., Grovic, M., Eajan, R., Pianta, R. and Griffiths, R. (2017) Show the evidence: building a movement around research, impact in Ed Tech, <https://www.the74million.org/article/showtheevidence-building-a-movement-around-research-impact-in-edtech/>, accessed 25<sup>th</sup> January, 2018; Luke, C., Marland, J., Resch, A., Stanhope, D. and Stevens, K. (2017) Analysis. No gold standard in Ed Tech, continuum of evidence needed to ensure technology helps students, <https://www.the74million.org/article/analysis-no-gold-standard-in-ed-tech-continuum-of-evidence-needed-to-ensure-technology-helps-students/>, accessed 25<sup>th</sup> January 2018; Francisco, A. and Epstein, B. (2017) Limited evidence in Edtech: everyone agrees – it isn't their fault, <http://symposium.curry.virginia.edu/limited-evidence-edtech-everyone-agrees-isnt-fault/>, accessed 25<sup>th</sup> January 2018.

- 1 See for example UNICEF/AKF/IU (2017) The Opportunities and Challenges of edtech (Draft)
- 1 Typical of this is the following: Escueta, M., Quan, V., Nickow, A.J. and Oreopoulos, P. (2017) *Education Technology: an evidence-based review*, Cambridge MA: National Bureau for Economic Research, <https://www.povertyactionlab.org/sites/default/files/publications/NBER-23744-EdTech-Review.pdf>, accessed 22 January 2018. This used Randomised Controlled Trials (RCTs) and Regression Discontinuity Designs (RDDs) mainly in developed countries, but also makes claims with reference to developing countries, despite the very different circumstances pertaining there. It is also insufficiently self-critical about the challenges of using RCTs and RDDs.
- 1 Although for the use of RCTs in an African context, see Advantech Consultants (2017) Project iMlango Endline Evaluation Report, <https://static1.squarespace.com/static/593eac48419c2335f2198e1/t/595a48e3b3db2be61096604a/1499089141879/iMlango+Endline+Evaluation+Report.pdf>, accessed 3rd March 2018.
- 1 Solomon Islands Government (2016) ICT for better education, <http://www.mehrd.gov.sb/87-general/181-ictforbe>, accessed 16th January 2018.
- 1 Chatterley, C. and Thomas, A. (2013) *Snapshot of WASH in Schools in Eastern & Southern Africa: A review of data, evidence and inequalities in the region*, Nairobi: UNICEF, [https://www.unicef.org/wash/schools/files/Snapshot\\_of\\_WASH\\_in\\_Schools\\_in\\_Eastern\\_and\\_Southern\\_Africa\(1\).pdf](https://www.unicef.org/wash/schools/files/Snapshot_of_WASH_in_Schools_in_Eastern_and_Southern_Africa(1).pdf), accessed 25th January 2018.
- 1 DFID is currently launching an important initiative to do just this, by creating a new ICT in education hub that will collate and promote research relating to the use of ICTs in education <https://supplierportal.dfid.gov.uk/selfservice/pages/public/viewPublicNotice.cmd?bm90aWNISWQ9NzA4OTA%3D>, accessed 16 January 2018.
- 1 Kamakshi, S. (2013) 10,000 HP Pavilion G4 Notebooks distributed by the Akhilesh Yadav Govt in UP, <http://www.abufarhanazmi.com/img/gallery/image03-big.jpg>, accessed 16yj January 2018.
- 1 The NEPAD e-Schools initiative (2007) <http://ela-newsportal.com/the-nepad-e-schools-initiative/>, accessed 16th January 2018.
- 1 Although see Farrell, G., Isaacs, S. and Trucano, M. (2007) *The NEPAD e-Schools Demonstration Project: a Work in Progress*, Washington: infoDev/The World Bank, [http://www.infodev.org/infodev-files/resource/InfodevDocuments\\_355.pdf](http://www.infodev.org/infodev-files/resource/InfodevDocuments_355.pdf), accessed 15th January 2018.
- 1 Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- 1 Newman, D., Jaciw, A.P. and Lazarev, V. (2017) *Guidelines for Conducting and Reporting EdTech Impact Research in US K-12 Schools*, Palo Alto: Empirical Education and ETIN
- 1 Wagner, D.A., Day, B., James, T., Kozma, R.B., Miller, J., and Unwin, T. (2005) *The Impact of ICTs in Education for Development: a Monitoring and Evaluation Handbook*, Washington DC: infoDev, [http://www.infodev.org/infodev-files/resource/InfodevDocuments\\_9.pdf](http://www.infodev.org/infodev-files/resource/InfodevDocuments_9.pdf), accessed 16th January 2018; for a more recent work, see Newman, D., Jaciw, A.P. and Lazarev, V. (2017) *Guidelines for Conducting and Reporting EdTech Impact Research in US K-12 Schools*, Palo Alto: Empirical Education and ETIN.

## 2.2 Context, scale and sustainability

- 1 Graham, M (2013) Kenya's laptops for schools dream fails to address reality, <https://www.theguardian.com/global-development/poverty-matters/2013/jun/27/kenya-laptops-schools>, accessed 25<sup>th</sup> January 2018.
- 1 Odero, K. (2015) It's all systems go for Kenya's digital learning project as devices arrive from China, <https://www.iafrikan.com/2016/10/04/kenya-laptop-project/>, accessed 25<sup>th</sup> January 2017.
- 1 Despite Rwanda's ambitious aims to have 92% 4G coverage by the end of 2017, isolated areas of the country will still remain digitally marginalised. [http://www.xinhuanet.com/english/2017-01/08/c\\_135964571.htm](http://www.xinhuanet.com/english/2017-01/08/c_135964571.htm), accessed 25<sup>th</sup> January 2018.
- 1 OECD (2016) *PISA 2015 results (Volume I): Excellence and Equity in Education*, Paris: OECD; UNESCO (2017) *Global Education Monitoring Report 2017/8. Accountability in Education: Meeting our Commitments*, Paris: UNESCO, <http://unesdoc.unesco.org/images/0025/002593/259338e.pdf#page=247>, accessed 16<sup>th</sup> February 2018.
- 1 This generalisation continues to drive many ICT for education initiatives, but as later sections of this report make clear, ICTs do indeed also have considerable potential for personalised approaches to learning.
- 1 <https://www.ceibal.edu.uy/en/institucional>, accessed 25<sup>th</sup> January 2018.
- 1 Trucano, M. (2011) What's next for plan Ceibal in Uruguay, <http://blogs.worldbank.org/edutech/planceibal2>, accessed 25<sup>th</sup> January 2018; Trucano, M. (2016) How students in Uruguayan schools are being taught English over the Internet by teachers in Arentina – and in the UK & the Philippines, <http://blogs.worldbank.org/edutech/category/tags/plan-ceibal>, accessed 5<sup>th</sup> January 2018. For a balanced overview of the Plan Ceibal, see Severin, E. (2016) *Building and sustainaing national ICT/education agencies: Lessons from Uruguay (Plan Ceibal)*, World Bank Education, Technology & Innovation: SABER-ICT Technical Paper Series (#09), Washington DC: The World Bank.

## 2.3 Positive and normative accounts of ICT in education

- 1 Economist Intelligence Unit (2016) *Yidan Prize Forecast: Education to 2030*, London: Economist Intelligence Unit, p.16, [https://www.eiuperspectives.economist.com/sites/default/files/EIU\\_Yidan%20prize%20forecast\\_Education%20to%202030.pdf](https://www.eiuperspectives.economist.com/sites/default/files/EIU_Yidan%20prize%20forecast_Education%20to%202030.pdf), accessed 26<sup>th</sup> January 2018.
- 1 See UNESCO (2016) *Global Education Monitoring Report. Education for People and Planet: Creating Sustainable Futures for All*, Paris; UNESCO, <http://unesdoc.unesco.org/images/0024/002457/245752e.pdf>, accessed 26<sup>th</sup> January 2018.
- 1 World Bank (2018) *World Development Report: Learning to Realize Education's Promise*, Washington DC: World Bank, p.3.
- 1 Altinok, N., Angrist, N. and Patrinos, H.A. (2018) *Global data set on education quality (1965-2015)*, Washington DC: World Bank, Policy Research Working Paper WPS8314. This argues strongly that although variations in education

quality are high in developing countries, the top performing countries in this group still often perform less well than the bottom performers in developed countries.

- 1 PISA (2015) *PISA results in focus*, Paris: OECD, <https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf>, accessed 26<sup>th</sup> January 2018.

## 2.4 Enabling the promises of ICT for beneficially transforming education

- 1 <https://twitter.com/AlibabaGroup/status/956129698987347968>, accessed 26<sup>th</sup> January 2018.
- 1 ITU, ICTs for a sustainable world, <https://www.itu.int/en/sustainable-world/Pages/default.aspx>, accessed 26<sup>th</sup> February 2018
- 1 ITU, Goal 4. Education, <https://www.itu.int/en/sustainable-world/Pages/goal4.aspx>, accessed 26<sup>th</sup> January 2018.
- 1 See for example GSMA (2018) *The Mobile Gender Gap Report 2018*, London: GSMA, GSMA (2018) *The Mobile Gender Gap Report 2018*, London: GSMA, <https://www.gsma.com/mobilefordevelopment/programmes/connected-women/the-mobile-gender-gap-report-2018>, accessed 3<sup>rd</sup> March 2018.
- 1 Economist Intelligence Unit (2016) *Yidan Prize Forecast: Education to 2030*, London: Economist Intelligence Unit, p.5, [https://www.eiuperspectives.economist.com/sites/default/files/EIU\\_Yidan%20prize%20forecast\\_Education%20to%202030.pdf](https://www.eiuperspectives.economist.com/sites/default/files/EIU_Yidan%20prize%20forecast_Education%20to%202030.pdf), accessed 26<sup>th</sup> January 2018.
- 1 ITU in partnership with UN-OHRLLS (2018) *ICTs, LDCs and the SDGs: Achieving Universal and Affordable Internet in the Least Developed Countries*, Geneva: ITU, [https://www.itu.int/dms\\_pub/itu-d/opb/lcd/D-LDC-ICTLDC-2018-PDF-E.pdf](https://www.itu.int/dms_pub/itu-d/opb/lcd/D-LDC-ICTLDC-2018-PDF-E.pdf), accessed 26<sup>th</sup> January 2018.
- 1 ITU (2018) UN Broadband Commission sets global broadband targets to bring online the world's 3.8 billion not connected to the Internet, <https://www.itu.int/en/mediacentre/Pages/2018-PR01.aspx>, accessed 26<sup>th</sup> January 2018
- 1 A useful overview of the importance of infrastructure, affordability and skills/awareness is provided by: World Economic Forum (2016) *Internet for All: A framework for accelerating Internet access and adoption*, Geneva: World Economic Forum,
- 1 Washington Post (2105) 1.3 billion are living in the dark, <https://www.washingtonpost.com/graphics/world/world-without-power/>, accessed 26<sup>h</sup> January 2018.
- 1 M-KOPA provides an innovative way of using mobile technologies to help pay for solar installations in relatively poor households in east Africa, <http://www.m-kopa.com/>, accessed 26<sup>th</sup> January 2018.
- 1 UNDESA (2014) *Electricity and education: the benefits, barriers, and recommendations for achieving the electrification of primary and secondary schools*, <https://sustainabledevelopment.un.org/content/documents/1608Electricity%20and%20Education.pdf>, accessed 26<sup>th</sup> January 2018.
- 1 Yousafzai, A. (2017) More than 50% government schools functioning without electricity in metropolis, *Daily Times*, <https://dailytimes.com.pk/118192/more->



[than-50-government-schools-functioning-without-electricity-in-metropolis/](#), accessed 26<sup>th</sup> January 2018.

- <sup>1</sup> For an important recent overview of systemic change in education, see Schleicher, A. (2018) *World Class: How to Build a 21<sup>st</sup>-century School System*, Paris: OECD, DOI:<http://dx.doi.org/10.1787/9789264300002-en>, [https://read.oecd-ilibrary.org/education/world-class\\_9789264300002-en#page5](https://read.oecd-ilibrary.org/education/world-class_9789264300002-en#page5), accessed 6<sup>th</sup> June 2018.
- <sup>1</sup> World Economic Forum (2017) These are the 10 best countries for skills and education, <https://www.weforum.org/agenda/2017/09/these-are-the-ten-best-countries-for-skill-and-education/>, accessed 26<sup>th</sup> January 2018.
- <sup>1</sup> OECD (2012) Does money buy strong performance in PISA?, <https://www.oecd.org/pisa/pisaproducts/pisainfocus/49685503.pdf>, accessed 26<sup>th</sup> January 2018.
- <sup>1</sup> Finnish National Agency for Education (2016) Subject teaching in Finnish schools is not being abolished, [http://www.oph.fi/english/current\\_issues/101/0/subject\\_teaching\\_in\\_finnish\\_schools\\_is\\_not\\_being\\_abolished](http://www.oph.fi/english/current_issues/101/0/subject_teaching_in_finnish_schools_is_not_being_abolished), accessed 14 August 2017; World Economic Forum (2016) Finland has one of the world's best education systems. Here's how it compares to the US, <https://www.weforum.org/agenda/2016/11/finland-has-one-of-the-worlds-best-education-systems-four-ways-it-beats-the-us>, accessed 25<sup>th</sup> January 2018. See also Aedo, c., Alasuutari, H. and Välijärvi (2017) Finland's 'education miracle' and the lessons we can learn, [https://www.weforum.org/agenda/2017/07/finlands-education-miracle-and-the-lessons-we-can-learn?utm\\_content=bufferb6605&utm\\_medium=social&utm\\_source=twitter.com&utm\\_campaign=buffer](https://www.weforum.org/agenda/2017/07/finlands-education-miracle-and-the-lessons-we-can-learn?utm_content=bufferb6605&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer), accessed 28<sup>th</sup> January 2018; and Kennedy, J. (2017) Inside a Finnish school: what Finland can teach the world about education, Silicon Republic, <https://www.siliconrepublic.com/careers/finland-education-schools-slush>, accessed 28<sup>th</sup> January 2018.
- <sup>1</sup> Jaakola, T. (no date) ICT in Finnish education and ICT education in Finland, University of Turku, [https://sisu.ut.ee/sites/default/files/ict/files/tomi\\_jaakkola\\_0.pdf](https://sisu.ut.ee/sites/default/files/ict/files/tomi_jaakkola_0.pdf), accessed 26<sup>th</sup> January 2018.
- <sup>1</sup> Office for National Statistics (2018) Children's engagement with the outdoors and sports activities, UK: 2014-2015, [https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/childrensengagementwiththeoutdoorsandsportsactivitiesuk/2014to2015?WT.mc\\_id=835075ecd17472dd39334079ba6b1643&WT.sn\\_type=TWITTER&hoot.message=How%20do%20children%20spend%20their%20time%20outdoors%3F%20We%20analysed%20children%E2%80%99s%20self-recorded%20time%20use%20data%20to%20find%20out%20%5BLINK%5D&hoot.send\\_date=0183-05-31%2000%3A00%3A00&hoot.username=ONS&hoot.send\\_dayofweek=Tuesday&hoot.send\\_hour=00](https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/childrensengagementwiththeoutdoorsandsportsactivitiesuk/2014to2015?WT.mc_id=835075ecd17472dd39334079ba6b1643&WT.sn_type=TWITTER&hoot.message=How%20do%20children%20spend%20their%20time%20outdoors%3F%20We%20analysed%20children%E2%80%99s%20self-recorded%20time%20use%20data%20to%20find%20out%20%5BLINK%5D&hoot.send_date=0183-05-31%2000%3A00%3A00&hoot.username=ONS&hoot.send_dayofweek=Tuesday&hoot.send_hour=00), accessed 31<sup>st</sup> January 2018.
- <sup>1</sup> Childwise (no date) Childhood 2016: Major shift in UK children's behaviour as time online overtakes time watching TV for first time ever, reveals new report, [http://www.childwise.co.uk/uploads/3/1/6/5/31656353/childwise\\_press\\_release\\_-\\_monitor\\_2016.pdf](http://www.childwise.co.uk/uploads/3/1/6/5/31656353/childwise_press_release_-_monitor_2016.pdf), accessed 31<sup>st</sup> January 2018.

- 1 Results for Development (2016) *Global Book Fund Feasibility Study*, Washington DC: Results for Development, <http://www.r4d.org/projects/feasibility-study-global-book-fund/>, accessed 26<sup>th</sup> January 2018.
- 1 Good examples of MOOCs developed for teacher training by the School of Education at Peking University are available at <http://tmooc.icourses.cn/>, accessed 28<sup>th</sup> January 2018.
- 1 Di Wu (2014) An introduction to ICT in education in China, in Huang R., Kinshuk, Price J. (eds) *ICT in Education in Global Context*, Berlin: Springer, 65-84.
- 1 Jigsaw Consult (2014) MBRSLP Research 2013-2014, <https://www.pdfFiller.com/299517646-MBRSLP-research-2013-2014pdf-Jigsaw-Consult-Document-Mohammed-Bin-Rashid-Smart-Learning-smartlearning-gov-Variou-Fillable-Forms>, accessed 15 October 2016.
- 1 EFA GMR (2015) The challenge of teacher shortage and quality: have we succeeded in getting enough quality teachers into classrooms? Paris: UNESCO Education for All Global Monitoring Report, Policy Paper 19. <http://unesdoc.unesco.org/images/0023/002327/232721E.pdf>, accessed 26<sup>th</sup> January 2018.
- 1 The Guardian, 25 July 2017, More than 600,000 pupils in England taught by unqualified teachers, say Labour, <https://www.theguardian.com/education/2017/jul/25/more-than-600000-pupils-in-england-taught-by-unqualified-teachers>, accessed 26<sup>th</sup> January 2018.
- 1 Assefa T. (2017) Educational Technology Implementation in Ethiopian High Schools: Benefits and Challenges of the Instructional Plasma TV. In: Marcus-Quinn A., Hourigan T. (eds) *Handbook on Digital Learning for K-12 Schools*. Cham: Springer, Cham, 413-427.
- 1 Sugata Mitra [www.ncl.ac.uk/ecls/staff/profile/sugatamitra.html#background](http://www.ncl.ac.uk/ecls/staff/profile/sugatamitra.html#background), accessed 26<sup>th</sup> January 2018.
- 1 Robots could start to replace teachers within 10 years, <https://www.weforum.org/agenda/2017/12/why-robots-could-replace-teachers-as-soon-as-2027>, accessed 26<sup>th</sup> January 2018.
- 1 <https://www.cmu.edu/scs/robotutor/>, accessed 31<sup>st</sup> January 2018
- 1 National Center on Education and the Economy (2016) *Empowered Educators: How High-Performing Systems Shape Teaching Quality Around the World. Finland: Constructing Teacher Quality*, Washington DC: National Center on Education and the Economy. See also Darling-Hammond, L., Burns, D., Campbell, C., Lin Goodwin, A., Hammerness, K., Low, E-L., McIntyre, A., Sato, M. and Zeichner, K. (2017) *Empowered Educators: How High-Performing Systems Shape Teaching Quality Around the World*, New York: Wiley.
- 1 See for example, Redecker, C. (2017) *European Framework for the Digital Competence of Teachers*, Luxembourg: Publications of the European Union.
- 1 See for example Unwin, T. (2005) Towards a framework for the use of ICT in teacher training in Africa, *Open Learning: The Journal of Open and Distance Education*, 20(2), 113-129
- 1 UNESCO (2011). *UNESCO ICT Competency Framework for Teachers*, <http://unesdoc.unesco.org/images/0021/002134/213475e.pdf>, accessed 26<sup>th</sup> January 2018.
- 1 Teachers First <http://teachersfirstegypt.com/about/what-is-tf/>, accessed 26<sup>th</sup> January 2018.

- 1 <https://www.apple.com/uk/education/apps-books-and-more/>, accessed 27<sup>th</sup> January 2018.
- 1 Olmstead, K. and Atkinson, M. (2015) An analysis of Apps in the Google Play Store, Pew Research Center *Internet & Technology*, <http://www.pewinternet.org/2015/11/10/an-analysis-of-apps-in-the-google-play-store/>, accessed 27<sup>th</sup> January 2018.
- 1 <https://www.educationalappstore.com/app-lists/apps-for-education>, accessed 2<sup>nd</sup> February 2018.
- 1 <http://www.naec.org.uk/ultralab/ww3/projects/notschool/>, accessed 27<sup>th</sup> January 2018.
- 1 Pogorsky, E. (2015) Using personalisation to improve the effectiveness of global educational projects, *E-Learning and Digital Media*, 12(1), 57-67.
- 1 Kohn, A. (2015) Four reasons to worry about “personalized learning”, *Psychology Today*, <https://www.psychologytoday.com/blog/the-homework-myth/201502/four-reasons-worry-about-personalized-learning>, accessed 27<sup>th</sup> January 2018.
- 1 For a wealth of advice and information about resources see <http://davebanesaccess.org/>, accessed 27<sup>th</sup> January 2018. See also <https://disabilityict4d.wordpress.com/>, accessed 27<sup>th</sup> January 2018.
- 1 UNESCO (2011) Consultative expert meeting report. Accessible ICTs and Personalised Learning for Students with disabilities: a dialogue among educators, industry, government and civil society, 17-18 November 2011, Paris: UNESCO, <http://unesdoc.unesco.org/images/0021/002198/219827e.pdf> accessed 27<sup>th</sup> January 2018; see also UNESCO (2011) *ICTs in Education for People with Disabilities: Review of Innovative Practice*, Paris: UNESCO and European Agency for Development in Special Needs Education, accessed 28<sup>th</sup> January 2018.
- 1 Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- 1 See, for example, British Dyslexia Association (2013) Using technology to support dyslexic pupils, <http://www.bdadyslexia.org.uk/common/ckeditor/filemanager/userfiles/Services/QM/Technology-for-Literacy-2013.pdf>, accessed 27<sup>th</sup> January 2018.
- 1 ITU (2018) Digital Skills Toolkit, Geneva: ITU, <https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/ITU%20Digital%20Skills%20Toolkit.pdf>, accessed 28<sup>th</sup> March 2018.
- 1 Bridge, M. (2017) Teach girls to code aged 2, says computer pioneer dame Stephanie Shirley, *The Times*, 21 August 2017, <https://www.thetimes.co.uk/article/bring-girls-into-computing-by-teaching-coding-from-the-age-of-two-2fcz605zx>, accessed 27<sup>th</sup> January 2018.
- 1 Hague, C. and Payton, S. (2010) *Digital Literacy Across the Curriculum: A Futurelab Handbook*, Bristol: Futurelab, <https://www.nfer.ac.uk/publications/FUTL06/FUTL06.pdf>, accessed 28<sup>th</sup> January 2018.

## 2.5 The limitations and problems with using ICTs in education

- 1 UNICEF (2017) *State of the World's Children 2017: Children in a Digital World*, New York: UNICEF; and see also examples of research and practice from Global Kids Online, <http://globalkidsonline.net/>, accessed 9<sup>th</sup> February 2018.
- 1 Biagi, F. and Loi, M. (2012) *ICT and Learning: Results from PISA 2009*, Luxembourg: Publications Office of the European Union. European Commission Joint Research Centre, JRC Scientific and Policy Reports.
- 1 OECD (2015) *Students, Computers and Learning: Making the Connection*, Paris: OECD, <http://dx.doi.org/10.1787/9789264239555-en>, accessed 28<sup>th</sup> January 2018.
- 1 OECD (2015) *Students, Computers and Learning: Making the Connection*, Paris: OECD, p.15.
- 1 Kirschner, P..A. and Neelen, M. (2016) Long live good old handwriting: an effective 'tool' for learning, <https://3starlearningexperiences.wordpress.com/2016/02/16/long-live-good-old-handwriting-an-effective-tool-for-learning/>, accessed 28<sup>th</sup> January 2018.
- 1 Anne Mangen, Bente R. Walgermo, and Kolbjorn Bronnack, "Reading linear texts on paper versus computer screen: Effects on reading comprehension," *International Journal of Educational Research*, Vol. 58 (2013): 61–68, <https://www.sciencedirect.com/science/article/pii/S0883035512001127>, accessed 28<sup>th</sup> January 2018.
- 1 For ongoing emphasis on bring your own device solutions in schools, see Bird, J. (2016) More pupils are told to 'bring your own device' as school budget cuts bite, *Financial Times*, 4 May 2016, <https://www.ft.com/content/c51f9ee0-f744-11e5-96db-fc683b5e52db>, accessed 29<sup>th</sup> January 2018.
- 1 See, for example: Howard, J. (2017) When kids get their first cell phones around the world, <https://flipboard.com/@flipboard/-when-kids-get-their-first-cell-phones-a/f-df38e69b54%2Fcnn.com>, accessed 29<sup>th</sup> January 2018.
- 1 The Times (2017) Schools ponder classroom ban on 'distracting' mobile phones, *The Times*, 13 September 2015, <https://www.thetimes.co.uk/article/schools-ponder-classroom-ban-on-distracting-mobile-phones-s2gs72l3cfb>, accessed 29<sup>th</sup> January 2018.
- 1 Economist (2017) Are digital distractions harming labour productivity, <https://www.economist.com/news/finance-and-economics/21732141-evidence-mixed-it-seems-clear-however-they-are-making-us?fsrc=scn/tw/te/bl/ed/aredigitaldistractionsharminglabourproductivityfreeexchange>, accessed 29<sup>th</sup> January 2018.
- 1 Kuznekoff, J.H. and Titsworth, S. (2013) The impact of mobile phone usage on student learning, *Communication Learning*, 62(3), 233-252, <https://doi.org/10.1080/03634523.2013.767917>, accessed 28<sup>th</sup> January 2018.
- 1 Beland, L-P. and Murphy, R. (2015) Ill communication: technology, distraction & student performance, London: LSE Centre for Economic Performance, Discussion Paper 1350, <http://cep.lse.ac.uk/pubs/download/dp1350.pdf>, accessed 28<sup>th</sup> January 2018.
- 1 See, for example, <https://www.weforum.org/agenda/2017/12/france-is-banning-mobile-phones-in-schools>, and

<https://www.theguardian.com/world/2017/dec/11/france-to-ban-mobile-phones-in-schools-from-september>, both accessed 29<sup>th</sup> January 2018.

- 1 Department of Education lifts ban on cell phones in New York City schools, <http://www.nydailynews.com/new-york/dept-education-ends-cell-phone-ban-nyc-schools-article-1.2134970>, accessed 29<sup>th</sup> January 2018.
- 1 UNICEF (2017) *State of the World's Children 2017: Children in a Digital World*, New York: UNICEF.
- 1 The two-way significance of this relationship is important, since it is not only children who suffer. It is also essential to consider the harassment and bullying of teachers by pupils, and many schools have guidance that teachers should not use social media such as Facebook.
- 1 For a good review, see Livingstone, S., Davidson, J., Bryce, J with Batool, S., Haughton, C and Nandi, A. (2017) *Children's Online Activities, Risks and Safety: a Literature Review by the UKCCIS Evidence Group*, London: LSE Consulting.
- 1 New measures to keep children safe online at school and at home, <https://www.gov.uk/government/news/new-measures-to-keep-children-safe-online-at-school-and-at-home>; see also the UK Council for Child Internet Safety guidance at <https://www.gov.uk/government/groups/uk-council-for-child-internet-safety-ukccis>, both accessed 29<sup>th</sup> January 2018.
- 1 As with its support for Global Kids Online, <http://globalkidsonline.net/>, accessed 9<sup>th</sup> February 2018.
- 1 UNICEF (2017) *Child Online Protection in India*, New Delhi: UNICEF, [http://unicef.in/Uploads/Publications/Resources/pub\\_doc115.pdf](http://unicef.in/Uploads/Publications/Resources/pub_doc115.pdf), accessed 29<sup>th</sup> January 2018; UNICEF (2017) *Keeping Children in Sri Lanka Safe and Empowered Online*, Sri Lanka: UNICEF and Institute for Participatory Interaction in Development, [https://www.unicef.org/srilanka/Unicef\\_Book\\_260118.pdf](https://www.unicef.org/srilanka/Unicef_Book_260118.pdf), accessed 3<sup>rd</sup> March 2018.
- 1 Better Kids <https://www.betterinternetforkids.eu>, and ITU Child Online Protection, <https://www.itu.int/en/cop/Pages/default.aspx>, accessed 29<sup>th</sup> January 2018.
- 1 The important work of the UK-based Internet Watch Foundation should, for example, be much better known and supported: <https://www.iwf.org.uk/>, accessed 7<sup>th</sup> February 2018.
- 1 Carney, M. (2015) Internet-addicted South Korean children sent to digital detox boot camp, <http://www.abc.net.au/news/2015-09-13/south-korean-children-seek-help-at-digital-detox-boot-camp/6769766>, accessed 29<sup>th</sup> January 2018.
- 1 Brown, L. (2017) Giving your child a smartphone is like giving them a gram of cocaine, says top addiction expert, [https://ideapod.com/giving-child-smartphone-like-giving-gram-cocaine-says-top-addiction-expert/?utm\\_content=buffer0a387&utm\\_medium=share&utm\\_source=facebook&utm\\_campaign=msa](https://ideapod.com/giving-child-smartphone-like-giving-gram-cocaine-says-top-addiction-expert/?utm_content=buffer0a387&utm_medium=share&utm_source=facebook&utm_campaign=msa), accessed 20<sup>th</sup> January 2018.
- 1 Pells, R. (2017) Primary school-age pupils sharing sexual content in the classroom, teachers warn, <http://www.independent.co.uk/news/education/education-news/pupils-sexual-content-classroom-teachers-warn-smartphone-children-naswt-police-a7680806.html>, accessed 29<sup>th</sup> January 2018.
- 1 Sloane, G. (2017) Sean Parker says Facebook was designed to be addictive, <http://adage.com/article/digital/sean-parker-worries-facebook-rotting-children-s-brains/311238/>, accessed 29<sup>th</sup> January 2018. See also Conrad, B. (2011) Why

- is Facebook addictive? <http://www.techaddiction.ca/why-is-facebook-addictive.html>, and Ghose, T. (2015) What Facebook addiction looks like in the brain, <https://www.livescience.com/49585-facebook-addiction-viewed-brain.html>, accessed 29<sup>th</sup> January 2018.
- 1 Twenge, J. (2017) Smartphones are damaging this generation's mental health, [https://www.weforum.org/agenda/2017/11/smartphones-are-damaging-this-generations-mental-health?utm\\_content=buffer9f872&utm\\_medium=social&utm\\_source=twitter.com&utm\\_campaign=buffer](https://www.weforum.org/agenda/2017/11/smartphones-are-damaging-this-generations-mental-health?utm_content=buffer9f872&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer), accessed 29<sup>th</sup> January 2018.
  - 1 Teitz, L. (2017) Personal data at risk as school districts become cybercrime targets, Government Technology, <http://www.govtech.com/security/Personal-Data-at-Risk-as-School-Districts-Become-Cybercrime-Targets.html>; and Hobbs, T.D. (2017) Hackers target nation's schools, <https://www.wsj.com/articles/hackers-target-nations-schools-1508751002>, both accessed 29<sup>th</sup> January 2018.
  - 1 The Times (2018) Schools under attack from sophisticated cybercriminals, *The Times*, 3 March 2018, p.18.
  - 1 See for example, the gathering of data in the UK by the US company ClassDojo Bridge, M. (2018) ClassDojo is harvesting data on how British schoolchildren behave, <https://www.thetimes.co.uk/article/c7530354-4a63-11e8-bf76-d5da08923eed>, accessed 7<sup>th</sup> June 2018.
  - 1 See <https://messengerkids.com/>. See also Facebook launches Messenger Kids app – but parents vet chat contacts, <https://www.theguardian.com/technology/2017/dec/04/messenger-kids-facebook-launches-under-13-chat-app-parental-contact-approval>, and Constine, J. (2017) Facebook 'Messenger Kids' lets under-13s chat with whom parents approve, <https://techcrunch.com/2017/12/04/facebook-messenger-kids/> all accessed 29<sup>th</sup> January 2018.
  - 1 Open letter to Mark Zuckerberg from the Campaign for a Commercial-Free Childhood dated 30<sup>th</sup> January 2018, <http://www.commercialfreechildhood.org/sites/default/files/develop-generate/gaw/FBMessengerKids.pdf>, accessed 31<sup>st</sup> January 2018.
  - 1 Clynes, M.E. and Kline, N.S. (1960) Cyborgs and space, *Astronautics*, 26-7 and 74-6; see also Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
  - 1 <https://www.theguardian.com/technology/2017/feb/15/elon-musk-cyborgs-robots-artificial-intelligence-is-he-right>, accessed 7<sup>th</sup> February 2018.
  - 1 <https://www.calicolabs.com/>, accessed 29<sup>th</sup> January 2018.
  - 1 For a journalistic account of current body hacking, see Jane Wakefield (2018) Would you hack your own body?, <https://www.bbc.co.uk/news/technology-42887405>, accessed 6<sup>th</sup> June 2018.
  - 1 Bartlett, J. (2014) *The Dark Net: Inside the Digital Underworld*, London: William Heinemann; Harrison, P and Wolyniak, J. (2015) The history of 'Transhumanism', *Notes and Queries*, 62(3), 465-67; Hutton, C. (2012) Google's Glass Castle: the rise and fear of a Transhuman future, <https://www.popmatters.com/163072-google-glass-castle-the-rise-and-fear-of-a-transhuman-future-2495816530.html>, accessed 29<sup>th</sup> January 2018.
  - 1 <https://kernel.co/>, accessed 28<sup>th</sup> January 2018.

- <sup>1</sup> Briggs, S. (2016) 6 ways digital media impacts the brain, *informed*, <https://www.opencolleges.edu.au/informed/features/5-ways-digital-media-impacts-brain/>, accessed 29<sup>th</sup> January 2018; see also UNICEF (2017) *The Adolescent Brain: A Second Window of Opportunity. A Compendium*, Florence: UNICEF Office of Research – Innocenti, <https://www.unicef-irc.org/publications/933-the-adolescent-brain-a-second-window-of-opportunity-a-compendium.html>, accessed 8<sup>th</sup> February 2018.
- <sup>1</sup> Economist Intelligence Unit (2016) *Yidan Prize Forecast: Education to 2030*, London: Economist Intelligence Unit, p.15, [https://www.eiuperspectives.economist.com/sites/default/files/EIU\\_Yidan%20prize%20forecast\\_Education%20to%202030.pdf](https://www.eiuperspectives.economist.com/sites/default/files/EIU_Yidan%20prize%20forecast_Education%20to%202030.pdf), accessed 26<sup>th</sup> January 2018.

## 2.6 Getting the balance right

- <sup>1</sup> Economist Intelligence Unit (2016) *Yidan Prize Forecast: Education to 2030*, London: Economist Intelligence Unit, p.10, [https://www.eiuperspectives.economist.com/sites/default/files/EIU\\_Yidan%20prize%20forecast\\_Education%20to%202030.pdf](https://www.eiuperspectives.economist.com/sites/default/files/EIU_Yidan%20prize%20forecast_Education%20to%202030.pdf), accessed 26<sup>th</sup> January 2018.

## 3. ICT interventions from which to learn

[Note that this section of the report was designed to provide evidence from a wide range of examples, not all of which were exclusively, or even mainly positive, for the learning outcomes of those who used them]

- <sup>1</sup> The choice of examples was heavily influenced by the views of those consulted during the course of the research for this report (see Annex 1 for list of those consulted). The final list of those included, though, remains the decision of the author.
- <sup>1</sup> Trucano, M. (2016) Promising uses of technology in education in poor, rural and isolated communities around the world, [http://www.unescobkk.org/information/news-from-unesco-bangkok/article/promising-uses-of-technology-in-education-in-poor-rural-and-isolated-communities-around-the-world/?utm\\_medium=twitter%252Fculture%252Fworld-heritage-and-immovable-heritage%252Fgis-and&cHash=187a59d6050be40108ce414be7fa467c](http://www.unescobkk.org/information/news-from-unesco-bangkok/article/promising-uses-of-technology-in-education-in-poor-rural-and-isolated-communities-around-the-world/?utm_medium=twitter%252Fculture%252Fworld-heritage-and-immovable-heritage%252Fgis-and&cHash=187a59d6050be40108ce414be7fa467c), accessed 21 August 2017.

### 3.1 Educational content and skills development

- <sup>1</sup> <https://www.coursera.org/>, accessed 29<sup>th</sup> January 2018.
- <sup>1</sup> <https://www.edx.org/>, accessed 29<sup>th</sup> January 2018.
- <sup>1</sup> <https://www.khanacademy.org>, accessed 29<sup>th</sup> January 2018.
- <sup>1</sup> <https://www.youtube.com/user/khanacademy>, accessed 29<sup>th</sup> January 2018.
- <sup>1</sup> <https://learningequality.org/ka-lite/>, accessed 29<sup>th</sup> January 2018.

- 1 <https://www.nafham.com/>, accessed 28th January 2018.
- 1 Khaled, F. (2016) The Middle East's largest educational platform is an Egyptian startup, <https://egyptianstreets.com/2016/05/08/the-middle-east-s-largest-educational-platform-is-an-egyptian-startup/>, accessed 29th January 2018.
- 1 <https://www.pearson.co.uk/about-us.html>, accessed 29th January 2018.
- 1 <http://ubongo.co/index.php/products/>, accessed 29th January 2018.
- 1 <https://shambashapeup.com/>, accessed 29th January 2018.
- 1 <https://learningequality.org/kolibri/>, accessed 29th January 2018.
- 1 This has been praised especially by Trucano from a World Bank perspective, <https://blogs.worldbank.org/edutech/20-innovative-edtech-projects-around-world> accessed 30 January 2018.
- 1 <https://ekstep.in/>, accessed 30th January 2018.
- 1 <https://apkpure.com/genie-beta-from-ekstep/org.ekstep.genieservices>, accessed 30th January 2018.
- 1 See <https://digitallibrary.io/about/global-digital-library>, accessed 10th April 2018.
- 1 <http://newsroom.wiley.com/press-release/all-corporate-news/wiley-and-kortext-partner-egyptian-knowledge-bank-ekb-grow-worlds-l>, and <http://www.springernature.com/gb/librarians/landing/ekb/>, both accessed 31st January 2018.
- 1 Kortext was founded in 2013 in the UK, and claims to be the UK's leading learning platform and supplier of digital textbooks. It works with over 1000 publishers, including Pearson, McGraw Hill and Wiley. <https://www.kortext.com/about-us>, accessed 31 January 2018.
- 1 Landau, D.M. (2015) 5 skills needed to succeed in a digital world, <https://iq.intel.com/5-skills-needed-to-succeed-in-a-digital-world/>, accessed 31st January 2018, argues strongly that Intel's training programmes for teachers enable them to ensure that young people gain the skills of collaboration, creativity, critical thinking and communication.
- 1 <https://onebillion.org>, accessed 31st January 2018
- 1 [https://www.memsource.com/blog/2017/02/07/multilingual-apps-to-educate-one-billion-children/?utm\\_source=onebillion&utm\\_medium=display&utm\\_content=blog\\_article](https://www.memsource.com/blog/2017/02/07/multilingual-apps-to-educate-one-billion-children/?utm_source=onebillion&utm_medium=display&utm_content=blog_article), accessed 31st January 2018.
- 1 The Connected Learning Initiative (CLIX) by Tata Institute of Social Sciences (TISS), Massachusetts Institute of Technology (MIT) and Tata Trusts wins the prestigious UNESCO King Hamad Bin Isa Al-Khalifa Prize, <http://www.tatatrsts.org/article/inside/unesco-king-hamad-bin-isa-al-khalifa-prize>, accessed 10th April 2018.
- 1 This was nevertheless below the initial targets of 1,100 schools, 1,100 Headmasters and 111,000 students, although more are likely to be reached by the end of 2018; see <https://clix.tiss.edu/about/>, accessed 10th April 2018.
- 1 Budhai, S. and Taddei, M. (2015) *Teaching the 4Cs with Technology: How do I use 21st Century Tools to teach 21st Century Schools*, Alexandria VA: ASCD Arias.
- 1 UNICEF Education <https://twitter.com/UNICEFEducation/status/959011428052226048>, accessed 1st February 2018.
- 1 <https://store.freedomscientific.com/collections/software-products/products/jaws-home-edition-screen-reader>, accessed 31st January 2018.



- 1 <https://www.nvaccess.org/>, accessed 31<sup>st</sup> January 2018.
- 1 <http://enuma.com/products/>, accessed 31<sup>st</sup> January 2018.
- 1 <http://kitkitschool.com/>, accessed 31<sup>st</sup> January 2018.

## 3.2 Pedagogy and the practice of teaching

- 1 For Microsoft's work in education, see <https://www.microsoft.com/en-gb/education/default.aspx>, accessed 31<sup>st</sup> January 2018.
- 1 See for example Intel's education programmes at <https://www.intel.com/content/www/us/en/education/intel-education.html?wapkw=evidence+of+impact?>, accessed 31<sup>st</sup> January 2-18.
- 1 Unwin, T. (2005) Towards a framework for the use of ICT in teacher training in Africa, *Open Learning: The Journal of Open and Distance Education*, 20(2), 113-129. See also *infoDev* (no date) Teachers, teaching and ICTs: a knowledge map on information and communication technologies in education, <http://www.infodiv.org/articles/teachers-teaching-and-icts>, accessed 31<sup>st</sup> January 2018.
- 1 Varkey Foundation, <https://www.varkeyfoundation.org/mission/what-we-do>, accessed 5<sup>th</sup> April 2018.
- 1 Hinostoza, E., Hepp, P., Laval, E. (2000) Enlaces: the Chilean ICT experience in education, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.109.102&rep=rep1&type=pdf>, accessed 31 January 2018.
- 1 Trucano, M. (2009) Linking up with Enlaces, World Bank EduTech Blog, <http://blogs.worldbank.org/edutech/linking-up-with-enlaces-chile>, accessed 31<sup>st</sup> January 2018.
- 1 <http://teachersfirstegypt.com/about/what-is-tf/>, accessed 31<sup>st</sup> January 2018.
- 1 See for example China Aid (2017) *Breaking the Barriers to Education: The Guide on Developing ICT Education for South Sudan*, Beijing: China Aid.
- 1 China Aid (2017) *Breaking the Barriers to Education: The Guide on Developing ICT Education for South Sudan*, Beijing: China Aid, pp. 92-93.
- 1 Queen Rania Teacher Academy, <http://www.qrta.edu.jo/who-we-are.html>, accessed 12<sup>th</sup> April 2018.

## 3.3 Digital skills

- 1 Broadband Commission (2017) *Working Group on Education: Digital Skills for Life and Work*, Paris: UNESCO and Broadband Commission, p.4, <http://www.broadbandcommission.org/Documents/publications/WG-Education-Report2017.pdf>, accessed 2<sup>nd</sup> February 2018.
- 1 ITU (2018) Digital Skills Toolkit, Geneva: ITU, <https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/ITU%20Digital%20Skills%20Toolkit.pdf>, accessed 28<sup>th</sup> March 2018.
- 1 See also emerging UNICEF policy on children and digital connectivity, which differentiates four different kinds of skills: safety skills, comprehension skills, social skills, and curation skills. All of these are visible in the discussions that

follow, although grouped in a rather different way so as to align with wider UN and other classifications. Comprehension and curation skills link closely with the discussions of the 4Cs of so-called 21<sup>st</sup> century skills; safety and social skills are directly discussed under the notion of living in an increasingly digital world.

- 1 The following classifications of digital skills are based on widely used conceptualisations: the Broadband Commission (2017) *Working Group on Education: Digital Skills for Life and Work*, Paris: UNESCO and Broadband Commission, <http://www.broadbandcommission.org/Documents/publications/WG-Education-Report2017.pdf> refers to basic functional skills, generic digital skills and higher level skills; and the OECD (2016) *Skills for a Digital World*, Paris: OECD, <http://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf>, refers to ICT specialist skills, ICT generic skills, ICT complementary skills, and other skills, both accessed 7<sup>th</sup> February 2018.
- 1 See also UNESCO (2014) *Global Citizenship Education: Preparing Learners for the Challenges of the 21st Century*, Paris, UNESCO, <http://unesdoc.unesco.org/images/0022/002277/227729E.pdf>; European Schoolnet (2016) *E-Skills Manifesto*, Brussels: European Schoolnet; OECD (2016) *Skills for a Digital World*, Paris: OECD, <http://www.oecd.org/els/emp/Skills-for-a-Digital-World.pdf>, all accessed 2<sup>nd</sup> February 2018.
- 1 Broadband Commission (2017) *Working Group on Education: Digital Skills for Life and Work*, Paris: UNESCO and Broadband Commission, pp.85-87, <http://www.broadbandcommission.org/Documents/publications/WG-Education-Report2017.pdf>, accessed 3<sup>rd</sup> February 2018.
- 1 <https://www.itu.int/en/ITU-D/Digital-Inclusion/Youth-and-Children/Pages/Digital-Skills.aspx>, accessed 14<sup>th</sup> February 2018
- 1 House of Commons, Science and Technology Committee (2016) *Digital Skills Crisis: Second Report of Session 2016-2017*, HC270, <https://publications.parliament.uk/pa/cm201617/cmselect/cmsctech/270/270.pdf>, accessed 3<sup>rd</sup> February 2018.
- 1 Teach girls to code aged 2, says computer pioneer Dame Stephanie Shirley, <http://www.newssummedup.com/summary/Teach-girls-to-code-aged-2-says-computer-pioneer-Dame-Stephanie-Shirley-yu2dgx>, accessed 3<sup>rd</sup> February 2018.
- 1 Digital Promise (2017) *Computational Thinking for a Computational World*, Digital Promise
- 1 IDMA (2017) New tech toys debut at pilot preschools as part of IDA's PlayMaker Programme, <https://www.imda.gov.sg/infocomm-and-media-news/buzz-central/2015/10/playmaker-changing-the-game>, accessed 30<sup>th</sup> March 2018.
- 1 <https://www.fondation-lamap.org/fr/123codez>, accessed 6<sup>th</sup> February 2018.
- 1 Broadband Commission (2017) *Working Group on Education: Digital Skills for Life and Work*, Paris: UNESCO and Broadband Commission, p.82, <http://www.broadbandcommission.org/Documents/publications/WG-Education-Report2017.pdf>, accessed 6<sup>th</sup> February 2018.
- 1 Unwin, E. (2016) NWED: Cambridge PhD student Ettie Unwin discusses the issues, *The Engineer*, 21 June 2016, <https://www.theengineer.co.uk/nwed-cambridge-phd-student-ettie-unwin-discusses-the-issues/>, accessed 6<sup>th</sup> February 2018.
- 1 <http://www.iamthecode.org>, accessed 6<sup>th</sup> February 2018.

- 1 Laboratoria, <http://www.laboratoria.la/en>, accessed 30<sup>th</sup> March 2018.
- 1 For a wider exposition, see Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- 1 Although see the work of the Digital Opportunity Trust (<https://www.dotrust.org/about/about-us/>, accessed 4<sup>th</sup> May 2018), which has focused on working with young people to help them become innovators and leaders, and to create and apply digital solutions that have positive impact in their communities.
- 1 Office for National Statistics (2018) Children's engagement with the outdoors and sports activities, UK: 2014-2015, [https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/childrensengagementwiththeoutdoorsandsportsactivitiesuk/2014to2015?WT.mc\\_id=835075ecd17472dd39334079ba6b1643&WT.sn\\_type=TWITTER&hoot.message=How%20do%20children%20spend%20their%20time%20outdoors%3F%20We%20analysed%20children%E2%80%99s%20self-recorded%20time%20use%20data%20to%20find%20out%20%5BLINK%5D&hoot.send\\_date=0183-05-31%2000%3A00%3A00&hoot.username=ONS&hoot.send\\_dayofweek=Tuesday&hoot.send\\_hour=00](https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/childrensengagementwiththeoutdoorsandsportsactivitiesuk/2014to2015?WT.mc_id=835075ecd17472dd39334079ba6b1643&WT.sn_type=TWITTER&hoot.message=How%20do%20children%20spend%20their%20time%20outdoors%3F%20We%20analysed%20children%E2%80%99s%20self-recorded%20time%20use%20data%20to%20find%20out%20%5BLINK%5D&hoot.send_date=0183-05-31%2000%3A00%3A00&hoot.username=ONS&hoot.send_dayofweek=Tuesday&hoot.send_hour=00); Childwise (no date) Childhood 2016: Major shift in UK children's behaviour as time online overtakes time watching TV for first time ever, reveals new report, [http://www.childwise.co.uk/uploads/3/1/6/5/31656353/childwise\\_press\\_release\\_-\\_monitor\\_2016.pdf](http://www.childwise.co.uk/uploads/3/1/6/5/31656353/childwise_press_release_-_monitor_2016.pdf), both accessed 31<sup>st</sup> January 2018.
- 1 Buchanan, R., Southgate, E., Smith, S.P., Murray, T. and Noble, B. (2017) Post no photos, leave no trace: children's digital footprint management strategies, *E-Learning and Digital Media*, 14(5), 275-90, <http://journals.sagepub.com/doi/10.1177/2042753017751711>; see also Buchanan, R. (2018) How to help children build a positive presence online, World Economic Forum [https://www.weforum.org/agenda/2018/01/why-children-should-be-taught-to-build-a-positive-online-presence?utm\\_content=buffer6051&utm\\_medium=social&utm\\_source=twitter.com&utm\\_campaign=buffer](https://www.weforum.org/agenda/2018/01/why-children-should-be-taught-to-build-a-positive-online-presence?utm_content=buffer6051&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer), both accessed 7<sup>th</sup> February 2018.
- 1 NSPCC, Safeguarding and child protection in schools, <https://www.nspcc.org.uk/preventing-abuse/safeguarding/schools-protecting-children-abuse-neglect/>; see also UK Council for Child Internet Safety, <https://www.gov.uk/government/groups/uk-council-for-child-internet-safety-ukccis>, both accessed 7<sup>th</sup> February 2018.
- 1 UNESCO (2014) *Global Citizenship Education: Preparing Learners for the Challenges of the Twenty-first Century*, Paris: UNESCO, <http://unesdoc.unesco.org/images/0022/002277/227729E.pdf>, accessed 7<sup>th</sup> February 2018.
- 1 World Vision International (2014) Keeping children safe online, <https://www.wvi.org/keeping-children-safe-online>; Mandy Yamanis for World Vision International (2016), Keeping children safe: an evolving effort, <https://www.wvi.org/blogpost/keeping-children-safe-evolving-effort>, both accessed 7<sup>th</sup> February 2018.

### 3.4 Monitoring and evaluation

- 1 Times of India (2015) Biometrics attendance for teachers from June, <https://timesofindia.indiatimes.com/city/pune/Biometrics-attendance-for-teachers-from-June/articleshow/46980678.cms>, accessed 7<sup>th</sup> February 2018.
- 1 Biometric attendance system in Punjab, <http://www.pakworkers.com/news/biometric-attendance-system-for-punjab-school-teachers-is-ready/>; in KPK Government colleges, <https://timesofislamabad.com/biometric-attendance-system-kpk-government-colleges/2016/08/31/>, both accessed 13<sup>th</sup> August 2017.
- 1 <http://www.iritech.com/blog/biometric-education/>, accessed 7<sup>th</sup> February 2018.
- 1 Jigsaw Consult (2014) MBRSLP Research 2013-2014, <https://www.pdfFiller.com/299517646-MBRSLP-research-2013-2014pdf-Jigsaw-Consult-Document-Mohammed-Bin-Rashid-Smart-Learning-smartlearning-gov-Various-Fillable-Forms>, accessed 15 October 2016.
- 1 Fundación Omar Dengo, [http://www.fod.ac.cr/index.php?option=com\\_content&view=article&id=81&Itemid=160&area=9&proyecto=46](http://www.fod.ac.cr/index.php?option=com_content&view=article&id=81&Itemid=160&area=9&proyecto=46), accessed 30<sup>th</sup> March 2018.
- 1 Fundación Omar Dengo, Investigación y Evaluación, Informática Educativa, [http://www.fod.ac.cr/index.php?option=com\\_content&view=article&id=1&Itemid=161](http://www.fod.ac.cr/index.php?option=com_content&view=article&id=1&Itemid=161), accessed 30<sup>th</sup> March 2018

### 3.5 Administration

- 1 Fung, A.C.W., Visscher, A.J., Barta, B-Z., and Teather, D.C.B. (eds) (1997) *Information Technology in Educational Management for the Schools of the Future*, Springer-Science+Business Media. For the example of Ghana's EMIS and data availability, see <http://www.ghanaeducationdata.com/index.aspx>, accessed 7<sup>th</sup> February 2018.
- 1 See for example GoSchool developed in Argentina, <https://www.goschool.com.ar/>, Prodigy, <http://www.prodigy.com.ng/pricing>,
- 1 <https://www.openemis.org/about/>, Synergy, <https://www.synisys.com/products/education-management-information-system/>, and Groupcall, <https://www.groupcall.com/>, all accessed 7<sup>th</sup> February 2018. EMISs can be at school, education district or Ministry levels, and should ideally cover all scales in an integrated way.
- 1 Bernbaum, M. and Moses, L. (2011) *EQUIP2 Lessons Learned in Education: Education Management Information Systems. A Guide to Education Project Design, Evaluation, and Implementation Based on Experiences from EQUIP2 Projects Malawi, Uganda and Zambia*, Washington DC: USAID, <https://www.fhi360.org/sites/default/files/media/documents/EQUIP2%20LL%20EMIS%20AAR.pdf>, accessed 7<sup>th</sup> February 2018.
- 1 Mutiwanyuka, C., Maiga, Y.A. and Bah, A. (2017) ADEA's role on education management information systems in Africa, <https://www.globalpartnership.org/blog/adeas-role-education-management-information-systems-africa>, accessed 8<sup>th</sup> February 2018.

- <sup>1</sup> See De Silva (2015) The impact of Education Management Information Systems: the case of Afghanistan, <http://blogs.worldbank.org/education/impact-education-management-information-systems-case-afghanistan>; see also World Bank (2017) SABER Country Report: Afghanistan Education Management information Systems, [http://wbfiles.worldbank.org/documents/hdn/ed/saber/supporting\\_doc/CountryReports/EMS/SABER\\_EMIS\\_Afghanistan\\_Country\\_Report\\_Final\\_2017.pdf](http://wbfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/CountryReports/EMS/SABER_EMIS_Afghanistan_Country_Report_Final_2017.pdf), accessed 7<sup>th</sup> February 2018.

### 3.6 Assessment

- <sup>1</sup> Recent estimates, for example, suggest that 17% of teachers in the UK spend more than 11 hours a week marking, and two-thirds of teachers say that the amount of time spent on marking negatively impacts the amount of classroom time that they can spend with children, <https://www.tes.com/news/school-news/breaking-news/workload-tens-thousands-teachers-spend-more-11-hours-marking-every>, accessed 7<sup>th</sup> February 2018.
- <sup>1</sup> <http://en.51chaoqun.com/>, accessed 8<sup>th</sup> February 2018.
- <sup>1</sup> See, for example, the WJEC which provide teachers, predominantly in Wales, with a question bank drawn from past examination papers so that they can set their pupils test papers before they have to sit public examinations; <http://www.wjec.co.uk/question-bank/>, accessed 7<sup>th</sup> February 2018.
- <sup>1</sup> See, for example, the Chartered Institute of Management Accountants past papers and answers, <http://www.cimaglobal.com/p1papers>, accessed 7<sup>th</sup> February 2018.
- <sup>1</sup> Microsoft, for example, is now making available around 300,000 OER resources through its OneNote Class Notebook, and also provides integrated assessments through Microsoft Forms, <https://educationblog.microsoft.com/2017/10/introducing-education-resources-a-source-of-open-educational-resources-within-office-365-2/>, accessed 8<sup>th</sup> February 2018.
- <sup>1</sup> <http://www.asp-schoolprojects.co.za/>, accessed 7<sup>th</sup> February 2018.
- <sup>1</sup> <http://cbseacademic.nic.in/#>, accessed 7<sup>th</sup> February 2018.

### 3.7 Access to the potential benefits of ICTs in education in low-resource environments

- <sup>1</sup> For a wide ranging review of the malleability of the brain and synaptic plasticity, see Schaefer, N. *et al.* (2017) The malleable brain: plasticity of neural circuits and behavior – a review from students to students, *Journal of Neurochemistry*, Epub ahead of print, doi: 10.1111/jnc.14107
- <sup>1</sup> <http://www.turnitin.com/>, accessed 7<sup>th</sup> February 2018.
- <sup>1</sup> <https://www.grammarly.com/plagiarism-checker>, accessed 7<sup>th</sup> February 2018.
- <sup>1</sup> Terzon, E. (2017) How the rise of apps in Australian classrooms is coming with privacy and learning concerns, <http://www.abc.net.au/news/2017-03-13/rise-of->

[parent-teacher-behaviour-apps-in-australian-classrooms/8340414](http://parent-teacher-behaviour-apps-in-australian-classrooms/8340414), accessed 8th February 2018.

- 1 Bridge, M. (2018) ClassDojo is harvesting data on how British schoolchildren behave, <https://www.thetimes.co.uk/article/c7530354-4a63-11e8-bf76-d5da08923eed>, accessed 7th June 2018.
- 1 See for example Microsoft's Teacher Dashboard for Microsoft Office 365, <http://www.teacherdashboard365.com/>, accessed 8th February 2018.
- 1 <https://www.go.literatorapp.com/>, accessed 8th February 2018.
- 1 Intelligent classroom behaviour management system in Hangzhou, <http://bbs.chinadaily.com.cn/forum.php?mod=viewthread&tid=1892506>, assessed 28th May 2018.
- 1 See for example Deloitte's guidance on test options, <https://www.graduatesfirst.com/portfolio-items/deloitte/>, accessed 8th February 2018.
- 1 Burns, J. (2013) Online tests to replace paper exams within a decade, <http://www.bbc.co.uk/news/education-24174535>, accessed 8th February 2018.
- 1 World Bank (2018) Improving Armenia's Unified Entrance exam with Computer-Based Testing, [http://www.worldbank.org/en/news/feature/2018/03/27/improving-armenias-unified-entrance-exam-with-computer-based-testing?cid=ECR\\_E\\_NewsletterWeekly\\_EN\\_EXT&deliveryName=DM2385](http://www.worldbank.org/en/news/feature/2018/03/27/improving-armenias-unified-entrance-exam-with-computer-based-testing?cid=ECR_E_NewsletterWeekly_EN_EXT&deliveryName=DM2385), accessed 10th April 2018.
- 1 For an example from the UAE see <http://gulfnnews.com/news/uae/education/students-hack-teacher-s-pc-to-leak-exam-papers-1.1111726>; for Singapore see <http://www.tnp.sg/news/singapore/smu-student-jailed-hacking-professors-accounts-delete-exam-scripts>, both accessed 8th February 2018.
- 1 For an Indian example see <http://www.financialexpress.com/india-news/neet-2017-result-news-in-shocking-admission-us-based-prometric-testings-says-its-software-was-hacked/779815/>, accessed 8th February 2018.
- 1 See for example, <https://null-byte.wonderhowto.com/how-to/hack-like-pro-hack-your-schools-server-download-final-exam-answers-0147465/>, <https://www.hindustantimes.com/delhi-news/online-app-that-hacks-your-exam-with-just-a-click/story-spDworRWnzXEX4xUWZUXoN.html>, and <https://deedy.quora.com/Hacking-into-the-Indian-Education-System>, all accessed 8th February 2018.
- 1 See for example the case of the AQA's online marking site being down in 2017 <https://www.tes.com/news/school-news/breaking-news/markers-unable-use-exam-board-aqas-online-system-gcse-deadlines-loom>, accessed 8th February 2018.
- 1 [http://www.huffingtonpost.co.uk/entry/student-hacking\\_n\\_4907344](http://www.huffingtonpost.co.uk/entry/student-hacking_n_4907344), accessed 8th February 2018.
- 1 For a wider discussion, see World Economic Forum (2016) *Internet for All: A framework for accelerating Internet access and adoption*, Geneva: World Economic Forum, and Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- 1 See also Unwin, T. (2015) Multistakeholder partnerships, in: Mansell, R. and Ang, P.H. (eds) *The International Encyclopedia of Digital Communication and Society*, Chichester: John Wiley, pp.634-44.
- 1 <http://www.m-kopa.com/>, accessed 8th February 2018.

- 1 <http://www.sarawakenergy.com.my/index.php/news-events-top/latest-news-events/latest-media-release/2039-electrification-of-bario-highlands-via-solar-hybrid-power-system>, accessed 8<sup>th</sup> February 2018.
- 1 See for example, <http://www.digisatmedia.net/en/education/?s=24E276D5986A312A88423AD0FEAAC8F0114440F3>, and <http://www.appliansys.com/cachebox/school/tech/overviews/>, both accessed 8<sup>th</sup> February 2018.
- 1 Advantech Consultants (2017) Project iMlango Endline Evaluation Report, <https://static1.squarespace.com/static/593eacf48419c2335f2198e1/t/595a48e3b3db2be61096604a/1499089141879/iMlango+Endline+Evaluation+Report.pdf>, accessed 3<sup>rd</sup> March 2018.
- 1 AT&T and DIRECTV Colombia: our social commitment, [http://www.about.att.com/content/csr/home/blog/2016/12/at\\_t\\_and\\_directvcol.html](http://www.about.att.com/content/csr/home/blog/2016/12/at_t_and_directvcol.html), accessed 30<sup>th</sup> March 2018.
- 1 <http://www.mehrd.gov.sb/87-general/181-ictforbe>, accessed 28 August 2017
- 1 <https://www.brck.com/education/>, accessed 8<sup>th</sup> February 2018.
- 1 Case study adapted from Unwin, T., Weber, M., Brugha, M. and Hollow, D. (2017) *The Future of Learning and Technology in Deprived Contexts*, London: Save the Children International, <https://resourcecentre.savethechildren.net/library/future-learning-and-technology-deprived-contexts>, accessed 30<sup>th</sup> January 2018.
- 1 <http://www.literacybridge.org/talking-book/>, accessed 8<sup>th</sup> February 2018.
- 1 <https://pi-top.com/>, accessed 12<sup>th</sup> April 2018.
- 1 Unwin, T., Tan, M and Pauso K. (2007) The potential of e-learning to address the needs of out-of-school youth in the Philippines, *Children's Geographies*, 5(4), 443-462.
- 1 End of project booklet <https://www.slideshare.net/mameltan/e-skwela-end-ofproject-booklet-7784656>, About the eSkwela project <https://als-eskwela.wikispaces.com/About>, and eSkwela report – turnover ceremonies, <https://www.slideshare.net/mameltan/eskwela-report-turnover-ceremonies-29-april-2011>, all accessed 8<sup>th</sup> February 2018.
- 1 <https://www.rappler.com/nation/169572-deped-special-als-desks-brigada-eskwela-2017>, accessed 8<sup>th</sup> February 2018.
- 1 For useful resources see the work of Zero Project, which is committed to sharing models that will improve the lives of all persons with disabilities <https://zeroproject.org/>, accessed 11<sup>th</sup> February 2018.
- 1 UNESCO (2011), *Accessible ICTs and Personalized Learning for Students with Disabilities: A Dialogue among Educators, Industry, Government and Civil Society*, Paris: UNESCO; and UNESCO (2016) *Digital Empowerment: Access to Information and Knowledge Using ICTs for Persons with Disabilities*, UNESCO: Paris
- 1 For a list of useful resources see <https://disabilityict4d.wordpress.com/useful-resources/>, accessed 8<sup>th</sup> February 2018.
- 1 Pakistan Telecommunication Authority (2017) *Annual Report 2017*, Islamabad: Pakistan Telecommunication Authority, [http://www.pta.gov.pk/assets/media/ann\\_rep\\_2017.pdf](http://www.pta.gov.pk/assets/media/ann_rep_2017.pdf), accessed 12<sup>th</sup> February 2018.

- 1 Global Campaign for Education and Handicap International (2013) *Equal Right, Equal Opportunity: Inclusive Education for Children with Disabilities*, Johannesburg: Global Campaign for Education.
- 1 <https://mada.org.qa>, accessed 12<sup>th</sup> February 2018.
- 1 <https://mada.org.qa/en/Pages/Education.aspx>, accessed 13<sup>th</sup> February 2018.
- 1 <https://allchildrenreading.org/innovators/institute-for-disabilities-research-and-training-incl/>, and <https://zeroproject.org/practice/practice/pra181033mor-factsheet/>, both accessed 11<sup>th</sup> February 2018.
- 1 <http://adradnepal.org/>, accessed 11<sup>th</sup> February 2018.
- 1 <https://zeroproject.org/practice/nepal-adrad/>, accessed 11<sup>th</sup> February 2018.
- 1 <http://ypsa.org/>, accessed 12<sup>th</sup> February 2018.
- 1 YPSA (no date) Daisy for all, <https://ypsa.org/?wpdmact=process&did=MjAuaG90bGluaw==> , accessed 12<sup>th</sup> February 2018.
- 1 <http://www.daisy.org/>, accessed 12<sup>th</sup> February 2018.
- 1 <http://a2i.pmo.gov.bd/blog/books-for-all-a-dream-comes-true/>, accessed 12<sup>th</sup> February 2018.
- 1 See for example Tauson, M. and Stannard, L. (2018) *Edtech for Learning in Emergencies and Displaced Settings*, London: Save the Children UK, <https://www.savethechildren.org.uk/content/dam/global/reports/education-and-child-protection/edtech-learning.pdf>, both accessed 24<sup>th</sup> February 2018; and UNESCO (2018) *A Lifeline to Learning: Leveraging technology to Support Education for Refugees*, Paris: UNESCO, <http://unesdoc.unesco.org/images/0026/002612/261278e.pdf> accessed 27<sup>th</sup> March 2018; UNHCR (2017) Innovation transforms education for refugee students in Africa, <http://www.unhcr.org/afr/news/stories/2017/3/58c283da4/innovation-transforms-education-refugee-students-africa.html>, accessed 30<sup>th</sup> March 2018; the work of Techfugees, <https://techfugees.com/>, accessed 11<sup>th</sup> February 2018; and the ICT Inventory for Education in Emergencies, <http://ict.ineesite.org/>; and Vodafone (2017) Instant Network Schools: A Connected Education Programme, <http://www.vodafone.com/content/foundation/instant-network-schools.html>, both accessed 30<sup>th</sup> March 2018.
- 1 Much of this section builds on Unwin, T., Weber, M., Brugha, M. and Hollow, D. (2017) *The Future of Learning and Technology in Deprived Contexts*, London: Save the Children International, <https://resourcecentre.savethechildren.net/library/future-learning-and-technology-deprived-contexts>, accessed 30<sup>th</sup> January 2018.
- 1 See, for example, *Forced Migration Review 35: Disability and Displacement*, University of Oxford Refugee Studies Centre, [www.g3ict.org/download/p/fileId\\_905/productId\\_219](http://www.g3ict.org/download/p/fileId_905/productId_219); UNHCR (2011) *Working with Persons with Disabilities in Forced Displacement*, Geneva: UNHCR, <http://www.refworld.org/pdfid/4e6072b22.pdf> both accessed 11<sup>th</sup> February 2018.
- 1 Although it is remarkable that reports such as Cambridge Education, on behalf of DAI, for DFID (2017) *Education in Emergencies Guidance Note*, London: DFID, makes only two substantive mentions of the use of ICTs in emergency contexts, [https://www.dai.com/uploads/EiE\\_Guidance\\_Note-8fc7f4.pdf](https://www.dai.com/uploads/EiE_Guidance_Note-8fc7f4.pdf), accessed 11<sup>th</sup> May 2018.



- <sup>1</sup> War Child (2013) *Education: Quality Learning Opportunities for Children Affected by Armed Conflict*. Amsterdam: War Child, [https://www.warchildholland.org/sites/default/files/bijlagen/node\\_2305/19-2014/education\\_brochure\\_for\\_online\\_low\\_resolution.pdf](https://www.warchildholland.org/sites/default/files/bijlagen/node_2305/19-2014/education_brochure_for_online_low_resolution.pdf); War Child (no date) *How War Child uses Media and IT*, Amsterdam: War Child, [https://www.warchildholland.org/sites/default/files/bijlagen/node\\_2305/11-2013/3912.1001\\_infographic\\_war\\_child\\_6.pdf](https://www.warchildholland.org/sites/default/files/bijlagen/node_2305/11-2013/3912.1001_infographic_war_child_6.pdf) both accessed 23 August 2017; fEud and Eid, N. (2015) Applying accessible telecentre for refugees with disabilities, <https://www.linkedin.com/pulse/applying-accessible-telecentre-refugees-disabilities-nabil-eid>, accessed 11<sup>th</sup> February 2018; Tauson, M. and Stannard, L. (2018) *Edtech for Learning in Emergencies and Displaced Settings*, London: Save the Children, <https://www.savethechildren.org.uk/content/dam/global/reports/education-and-child-protection/edtech-learning.pdf>, accessed 1<sup>st</sup> March 2018.
- <sup>1</sup> For further examples and detail, see: IASC (2007) *Guidelines on Mental Health and Psychosocial Support in Emergency Settings*. Geneva: Inter-Agency Standing Committee; UNHCR, IOM and MHPSS.net (2015) *Mental health and psychosocial support for refugees, asylum seekers and migrants on the move in Europe: a multi-agency guidance note*, <http://pscentre.org/wp-content/uploads/MHPSS-Guidance-note-FINAL-12-2015.pdf>; ipso e care, <https://www.ipso-ecare.com/home.html>; Almoshmosh, N., Mobayed, M. and Aljenci, M. (2016) Mental health and psychosocial needs of Syrian refugees and the role of Syrian non-governmental organisations, *BJPsych International*, 24(4), 81-83, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5619487/>; Pezerovic, A. and Babic, M.M. (2016) The importance of counselling support for refugees children, *Ljetopis socijalnog rada*, 23(3), 1-20, <https://hrcak.srce.hr/file/261520>; Allan, J. (2015) Reconciling the ‘psychosocial/structural’ in social work counselling with refugees, *British Journal of Social Work*, 45(6), 1699-1716; Providing peer social counselling to refugees in Germany, <https://evpa.eu.com/blog/providing-peer-social-counselling-to-refugees-in-germany>, all accessed 20<sup>th</sup> March 2018.
- <sup>1</sup> Lewis, K. & Thacker, S. (2016). *ICT and the Education of Refugees: A Stocktaking of Innovative Approaches in the MENA Region*. World Bank Education, Technology & Innovation. Washington, DC: The World Bank, accessed <https://openknowledge.worldbank.org/handle/10986/26522>, 25 August 2017.
- <sup>1</sup> UNICEF (no date) School-in-a-Box, [https://www.unicef.org/supply/index\\_40377.html](https://www.unicef.org/supply/index_40377.html), accessed 23 August 2017.
- <sup>1</sup> jp.ik showcases Popup School solution in Africa, <https://www.jpik.com/en/newsdetail/14911280/>, accessed 27<sup>th</sup> March 2018.
- <sup>1</sup> UNRWA (2017) *Delivering Education on the Front Line: the UNRWA Approach*. Amman: UNRWA [https://www.unrwa.org/sites/default/files/content/resources/2017\\_education\\_in\\_emergencies\\_fact\\_sheet\\_-\\_syria\\_v2.pdf](https://www.unrwa.org/sites/default/files/content/resources/2017_education_in_emergencies_fact_sheet_-_syria_v2.pdf), accessed 23 August 2017.
- <sup>1</sup> See for example, Eid, N. and Bischoff-Peters, U. (2016) Findings of the mission “Assessment on opportunities for telecentres” for the project Dohuk 2, GIZ.
- <sup>1</sup> See Badsah, A. (2013) ICT skills for world’s largest refugee camp, Microsoft, [https://blogs.technet.microsoft.com/microsoft\\_on\\_the\\_issues\\_africa/2013/05/29/ict-skills-for-worlds-largest-refugee-camp/](https://blogs.technet.microsoft.com/microsoft_on_the_issues_africa/2013/05/29/ict-skills-for-worlds-largest-refugee-camp/); UNHCR (2017) *Innovation transforms education for refugee students in Africa*,

<http://www.unhcr.org/uk/news/stories/2017/3/58c283da4/innovation-transforms-education-refugee-students-africa.html>, both accessed 23 August 2017.

- 1 See also Nethope's resources for refugee education and skills training, <https://solutionscenter.nethope.org/Resources-for-Refugee-Education-and-Skills-Training>, accessed 11<sup>th</sup> February 2018.
- 1 See also <http://www.basmeh-zeitooneh.org/>, <https://jusoorsyria.com/programs/refugee-education-program/>, and <http://www.alecso.org/refugee/>, all accessed 11<sup>th</sup> February 2018. For a good overall review of the research literature, see Tauson, M. and Stannard, L. (2018) *Edtech for Learning in Emergencies and Displaced Settings*, London: Save the Children UK, <https://www.savethechildren.org.uk/content/dam/global/reports/education-and-child-protection/edtech-learning.pdf>, accessed 24<sup>th</sup> February 2018. UNESCO (2018) *A Lifeline to Learning: Leveraging Technology to Support Education for Refugees*, Paris: UNESCO, <http://unesdoc.unesco.org/images/0026/002612/261278e.pdf> accessed 27<sup>th</sup> March 2018 provides details of some 53 refugee related projects and initiatives, and 35 apps and platforms (although many are generic and not specifically for refugees). The Promising Practices in Refugee Education joint initiative by Save the Children, UNHCR and Pearson also provides examples of useful case studies <https://www.promisingpractices.online/>, accessed 30<sup>th</sup> March 2018.
- 1 <http://www.xavierproject.org/about/>, accessed 11<sup>th</sup> February 2018.
- 1 <http://www.tamuka.org/>, accessed 11<sup>th</sup> February 2018.
- 1 <http://refugeesonrails.org>, accessed 11<sup>th</sup> February 2018.
- 1 <https://thefirehoseproject.com/>, <https://github.com/RefugeesOnRails>, and <https://www.freecodecamp.org/>, all accessed 11<sup>th</sup> February 2018.
- 1 Unwin, T., Weber, M., Brugha, M. and Hollow, D. (2017) *The Future of Learning and Technology in Deprived Contexts*, London: Save the Children International, <https://resourcecentre.savethechildren.net/library/future-learning-and-technology-deprived-contexts>, accessed 30<sup>th</sup> January 2018.
- 1 <http://ilp.unrwa.org/>, accessed 24 September 2017
- 1 <https://www.unrwa.org/resources/about-unrwa/education-emergencies>, accessed 24 September 2017
- 1 <http://ilp.unrwa.org/>, accessed 24 September 2017
- 1 <https://www.unrwa.org/newsroom/features/safe-learning-spaces-providing-haven-palestine-refugee-children-syria-learn-and>, accessed 24 September 2017
- 1 ITU (2017) ICT Facts and Figures 2017, <http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf>; see also Web Foundation (2016) Digging into data on the gender digital divide, <https://webfoundation.org/2016/10/digging-into-data-on-the-gender-digital-divide/>, both accessed 14<sup>th</sup> February 2018.
- 1 Figures kindly provided by Yannick Glemarec (UN Women), 14<sup>th</sup> February 2018.
- 1 <http://www.iamthecode.org/>, accessed 14<sup>th</sup> February 2018.
- 1 Hassan, B., Unwin, T. and Gardezi, A. (2018) Understanding the darker side of ICTs: gender, harassment and mobile technologies in Pakistan, *Information Technology and International Development*,

- 1 itu4u (2016) Perspectives from Pakistan – women in ICT engineering, <https://itu4u.wordpress.com/2016/07/29/perspectives-from-pakistan-women-in-ict-engineering/>, accessed 14<sup>th</sup> February 2018.
- 1 <http://www.4-traders.com/MICROSOFT-CORPORATION-4835/news/Microsoft-Additional-226-Computer-Labs-being-set-up-under-ICT-for-Girls-Programme-25846162/>, accessed 14<sup>th</sup> February 2018.
- 1 Plan International (no date) Girls in Pakistan unlock opportunities through ICT skills, <https://plan-international.org/girls-pakistan-unlock-opportunities-through-ict-skills>, accessed 14<sup>th</sup> February 2018.

### 3.8 Conclusions: context, credibility and commitment

- 1 See also, Unwin, T. (2013) ICTs for Education initiatives, <https://unwin.wordpress.com/2013/10/13/icts-for-education-initiatives/>, accessed 14<sup>th</sup> February 2018.
- 1 Trucano, M. (2016) Promising uses of technology in education in poor, rural and isolated communities around the world, [http://www.unescobkk.org/information/news-from-unesco-bangkok/article/promising-uses-of-technology-in-education-in-poor-rural-and-isolated-communities-around-the-world/?utm\\_medium=twitter%252Fculture%252Fworld-heritage-and-immovable-heritage%252Fgis-and&cHash=187a59d6050be40108ce414be7fa467c](http://www.unescobkk.org/information/news-from-unesco-bangkok/article/promising-uses-of-technology-in-education-in-poor-rural-and-isolated-communities-around-the-world/?utm_medium=twitter%252Fculture%252Fworld-heritage-and-immovable-heritage%252Fgis-and&cHash=187a59d6050be40108ce414be7fa467c), accessed 21 August 2017.

## 4. Policy and Programme Guidance for UNICEF: the effective use of ICTs

- 1 Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- 1 Unwin, T. and Wong, A. (2012) *Global Education Initiative: Retrospective on Partnerships for Education Development 2003-2011*, Geneva: World Economic Forum.
- 1 [http://expositions.bnf.fr/utopie/grand/3\\_95b1.htm](http://expositions.bnf.fr/utopie/grand/3_95b1.htm), accessed 16<sup>th</sup> February 2018.
- 1 Few such cases are publicly reported, although in the late 2000s in Rwanda the Permanent Secretary in the Ministry of Education was charged with corruption over dealings with computers for schools, <http://www.newtimes.co.rw/section/read/86277>, accessed 16<sup>th</sup> February 2018. This is but one example, and should not imply that Rwanda is any more or less corrupt than other countries. Indeed, the fact that it was reported can be seen in a positive light.
- 1 Bridge International Academies (2015) *The Bridge Effect: A Comparison of Early Grade Learning Gains in English and Maths 2013-14 Impact Evaluation Report*, <http://medalliance.wengine.com/wp-content/uploads/2016/08/EGRA-EGMA-2013-2014-White-Paper-latest.pdf>; but see also <http://globalinitiative-escr.org/wp-content/uploads/2017/07/Civil-society-call-on-investors-to-cease->

[support-to-Bridge-International-Academies.pdf](#), both accessed 16th February 2018.

- 1 <https://unwin.wordpress.com/2012/11/30/mike-trucanos-ten-worst-practices-in-e-learning/>, accessed 16th February 2018.
- 1 <https://www.unicef.org/education/>, accessed 9th January 2018.
- 1 UNICEF (2017) *State of the World's Children: Children in a Digital World*, <https://www.unicef.org/sowc2017/>, accessed 9th January 2018
- 1 <https://www.itu.int/en/mediacentre/Pages/2018-PR01.aspx>, accessed 19th February 2018.
- 1 <http://www.bbc.co.uk/news/uk-england-43114471>, accessed 19th February 2018.
- 1 Castleman, M. (2016) Dueling statistics: how much of the Internet is porn, *Psychology Today*, <https://www.psychologytoday.com/blog/all-about-sex/201611/dueling-statistics-how-much-the-internet-is-porn>, accessed 19th February 2018.
- 1 Sora Aoi: Japan's porn star who taught a Chinese generation about sex, <http://www.bbc.co.uk/news/world-asia-china-42640569>; The unmarried Pakistani woman who wrote about her sex life, <http://www.bbc.co.uk/news/blogs-trending-36213811>, both accessed 19th February 2018
- 1 See for example, McCullough, D. (2017) Testing assumptions in real time: promoting literacy in India with mobile technology, <http://www.r4d.org/blog/qa-testing-assumptions-real-time-promoting-literacy-india-mobile-technology/>, accessed 5th March 2018.
- 1 See for example, UNICEF (2017) *State of the World's Children: Children in a Digital World*, <https://www.unicef.org/sowc2017/>, accessed 9th January 2018
- 1 See for example Wagner, D.A., Day, B., James, T., Kozma, R.B., Miller, J., and Unwin, T. (2005) *The Impact of ICTs in Education for Development: a Monitoring and Evaluation Handbook*, Washington DC: infoDev, [http://www.infodiv.org/infodiv-files/resource/InfodivDocuments\\_9.pdf](http://www.infodiv.org/infodiv-files/resource/InfodivDocuments_9.pdf), accessed 16th January 2018.
- 1 The Global Innovation Fund, <https://www.gov.uk/international-development-funding/global-innovation-fund>, accessed 6th March 2018.
- 1 Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- 1 Innovate UK (2016) Why do innovations fail?, <https://innovateuk.blog.gov.uk/2016/03/11/why-do-innovations-fail/>, accessed 6th March 2018.
- 1 Holmes, R. (2015) What entrepreneurs can learn from failure, <https://www.weforum.org/agenda/2015/06/what-entrepreneurs-can-learn-from-failure/>, accessed 6th March 2018.
- 1 See also Jigsaw Consult (2014) MBRSLP Research 2013-2014, <https://www.pdfFiller.com/299517646-MBRSLP-research-2013-2014pdf-Jigsaw-Consult-Dokument-Mohammed-Bin-Rashid-Smart-Learning-smartlearning-gov-Variou-Fillable-Forms>, accessed 15 October 2016.
- 1 Techradar's 2018 review of free anti-virus software is available at <https://www.techradar.com/news/the-best-free-antivirus>, accessed 15th April 2018.
- 1 <https://www.statista.com/statistics/263437/global-smartphone-sales-to-end-users-since-2007/>, accessed 7th March 2018.

## 5. What next for ICTs and Education?

- <sup>1</sup> Although see Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.
- <sup>1</sup> <https://www.mobileworldcongress.com/about/press-release/gsm-wraps-hugely-successful-mobile-world-congress-2018/>, accessed 7<sup>th</sup> March 2018.
- <sup>1</sup> <https://www.gsma.com/mobilefordevelopment/>, accessed 7<sup>th</sup> March 2018.
- <sup>1</sup> Gemalto, <https://www.gemalto.com/iot/inspired/smart-cities>, accessed 7<sup>th</sup> March 2018.
- <sup>1</sup> Singh, S. (2014) Smart Cities – a \$1.5 trillion market opportunity, *Forbes*, <https://www.forbes.com/sites/sarwantsingh/2014/06/19/smart-cities-a-1-5-trillion-market-opportunity/#5eb203a46053>, accessed 7<sup>th</sup> March 2018.
- <sup>1</sup> See, for example, the Smart Village initiative, <http://e4sv.org/>, and the European Network for Rural Development Smart Villages programme, [https://enrd.ec.europa.eu/smart-and-competitive-rural-areas/smart-villages\\_en](https://enrd.ec.europa.eu/smart-and-competitive-rural-areas/smart-villages_en), both accessed 7<sup>th</sup> March 2018. Many such initiatives in poor areas of the world, though, are concentrating first on simply getting electricity to villages, let alone digital connectivity. A quick online search using Google on this date, for example, gave 105,00 results for “Smart Villages”, but 617,000 results for “Smart Cities”.
- <sup>1</sup> Unwin, T., Weber, M., Brugha, M. and Hollow, D. (2017) *The Future of Learning and Technology in Deprived Contexts*, London: Save the Children International, <https://resourcecentre.savethechildren.net/library/future-learning-and-technology-deprived-contexts>, accessed 30<sup>th</sup> January 2018.

### 5.1 The drivers for technology in education

- <sup>1</sup> UNESCO Institute for Statistics (2018) Fact Sheet No. 48: One in five children, adolescents and youths is out of school, UIS/FS/2018/ED/48, <http://uis.unesco.org/sites/default/files/documents/fs48-one-five-children-adolescents-youth-out-school-2018-en.pdf>, accessed 15<sup>th</sup> March 2018
- <sup>1</sup> UNESCO Institute for Statistics (2018) Fact Sheet No. 46: More than one-half of children and adolescents are not learning worldwide, UIS/FS/2018/ED/46, <http://uis.unesco.org/sites/default/files/documents/fs46-more-than-half-children-not-learning-en-2017.pdf>, accessed 15<sup>th</sup> March 2018.
- <sup>1</sup> EdTechXGlobal (2016) Global report predicts EdTech spend to reach \$252 bn by 2020, Cision PR newswire, <https://www.prnewswire.com/news-releases/global-report-predicts-edtech-spend-to-reach-252bn-by-2020-580765301.html>, accessed 26<sup>th</sup> January 2018; see also Tech Crunch (2018) Education technology is a global opportunity, <https://techcrunch.com/2018/01/19/education-technology-is-a-global-opportunity/>, accessed 17<sup>th</sup> April 2018.
- <sup>1</sup> Growth opportunities in the global education technology market 2017 – forecast to 2022 – research and markets, [https://www.morningstar.com/news/business-wire/BWIPREM\\_20180111006109/growth-opportunities-in-the-global-education-technology-market-2017-forecast-to-2022-research-and-markets.html](https://www.morningstar.com/news/business-wire/BWIPREM_20180111006109/growth-opportunities-in-the-global-education-technology-market-2017-forecast-to-2022-research-and-markets.html), accessed 7<sup>th</sup> March 2018.

- 1 UNDESA (2017) *World Population Prospects: the 2017 Revision*, New York: UNDESA, [https://esa.un.org/unpd/wpp/publications/Files/WPP2017\\_KeyFindings.pdf](https://esa.un.org/unpd/wpp/publications/Files/WPP2017_KeyFindings.pdf), accessed 7<sup>th</sup> March 2018
- 1 Max Roser and Mohamed Nagdy (2018) - "Projections of Future Education". *Published online at OurWorldInData.org*. Retrieved from: <https://ourworldindata.org/projections-of-future-education>, accessed 7<sup>th</sup> March 2018.
- 1 ILO (2017) *Inception Report for the Global Commission on the Future of Work*, Geneva: ILO [http://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms\\_591502.pdf](http://www.ilo.org/wcmsp5/groups/public/---dgreports/---cabinet/documents/publication/wcms_591502.pdf), accessed 1<sup>st</sup> March 2018.
- 1 Senecal de Fonseca, M. (2017) Bridging the IT skills gap: why we need to create a multigenerational workforce, <https://www.citrix.com/blogs/2017/09/29/bridging-the-it-skills-gap-why-we-need-to-create-a-multigenerational-workforce/>, accessed 7<sup>th</sup> March 2018.
- 1 Sanou, B. (2017) Digital skills: ITU and ILO launch global campaign to train 5 million youths, <http://news.itu.int/digital-skills-itu-and-ilo-launch-global-campaign-to-train-5-million-youths/>, accessed 7<sup>th</sup> March 2018.
- 1 Nie, Y. and Lau, S. (2010) Differential relations of constructivist and didactic instruction to student's cognition, motivation and achievement, *Learning and Instruction*, 20(5), 411-423.
- 1 Papert's advocacy of Constructionism, which advocated a much more student-centred and discovery-based learning approach, with students learning through project-related activities and making their own connections between different ideas, facilitated by teachers, was highly influential in the development of many ICT-based learning initiatives. See Papert, S. (1980) *Mindstorms: Children, Computers and Powerful Ideas*, New York: Basic Books; and Papert, S. (1993) *The Children's Machine: Rethinking School in the Age of the Computer*, New York: Basic Books.
- 1 [http://wiki.laptop.org/go/OLPC\\_Principles\\_and\\_Basic\\_information](http://wiki.laptop.org/go/OLPC_Principles_and_Basic_information), accessed 7<sup>th</sup> March 2018.

## 5.2 Technological futures in education: building on existing trends

- 1 See, for example, DESA (2017) *Frontier Issues: the impact of technological revolution on labour markets and income distribution*, [https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/2017\\_Aug\\_Frontier-Issues-1.pdf](https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/2017_Aug_Frontier-Issues-1.pdf), accessed 30<sup>th</sup> March 2018. There is considerable debate about the likely impact of AI on labour, and employment, with the latest OECD report arguing that the potential for AI to lead to considerable employment loss has been exaggerated in the past; see Nedelkoska, L. and Quintini, G. (2018) *Automation, skills use and training*, Paris: OECD, DELSA/ELSA/WD/SEM(2018)3, <https://www.oecd-ilibrary.org/docserver/2e2f4eea-en.pdf?expires=1522776823&id=id&accname=guest&checksum=A498DE4EAEA4DDCC90DBE424AFB8DB0A>, accessed 3<sup>rd</sup> April 2018.

- 1 See for example, Ramalingam, B., Hernandez, K., Prieto Martin, P. and Faith, B. (2016) *Ten Frontier Technologies for International Development*, Brighton: IDS, [https://www.gla.ac.uk/media/media\\_524607\\_en.pdf](https://www.gla.ac.uk/media/media_524607_en.pdf), accessed 30<sup>th</sup> March 2018.
- 1 World Economic Forum (2016) *The Fourth Industrial Revolution: what it means, how to respond*, <https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/>, accessed 30<sup>th</sup> March 2018.
- 1 Paper prepared by UNICEF and UNESCO for the UN's High-Level Committee on Programmes, March 2018.
- 1 Promethean (2017) *The State of Technology in Education Report 2017/18*, <http://www2.prometheanworld.com/education-technology-report>, accessed 31<sup>st</sup> March 2018.
- 1 Intel's Nidhi Chappell described the difference as follows: "AI is basically the intelligence – how we make machines intelligent, while machine learning is the implementation of the compute methods that support it. The way I think of it is: AI is the science and machine learning is the algorithms that make the machines smarter... So the enabler for AI is machine learning", <http://www.wired.co.uk/article/machine-learning-ai-explained>, accessed 30<sup>th</sup> March 2018; for an interesting recent report from India, see Artificial Intelligence Task Force (2018) *Report of the Artificial Intelligence Task Force*, India: Department of Industrial Policy and Promotion, <http://dipp.nic.in/whats-new/report-task-force-artificial-intelligence>, Accessed 23<sup>rd</sup> April 2018.
- 1 Vosloo, S. (2018) *The rise of Artificial Intelligence for International Development*, <https://www.ictworks.org/artificial-intelligence-international-development/#.WsymH8gh0u->, accessed 10<sup>th</sup> April 2018.
- 1 See, for example, Cisco (2012) *Council Rock schools in Pennsylvania save \$8.8 m on energy*, [http://us.comstor.com/documents/48138/case\\_study\\_c36706171.pdf](http://us.comstor.com/documents/48138/case_study_c36706171.pdf), accessed 31<sup>st</sup> March 2018.
- 1 See Intel, *The Internet of School Things*, <http://iotschool.org/>, accessed 31<sup>st</sup> March 2018.
- 1 Lego education, <https://education.lego.com/en-gb>, accessed 30<sup>th</sup> March 2018.
- 1 Bogatech, <http://www.bogatech.org>, accessed 30<sup>th</sup> March 2018.
- 1 Tumo, <https://tumo.org/en/whatistumo/>, accessed 30<sup>th</sup> March 2018.
- 1 See, UK Department for Education (2017) *Cloud computing services: guidance for school leaders, school staff and governing bodies*, UK: Department for Education, [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/584755/Cloud\\_computing\\_services\\_guidance\\_Jan\\_2017.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/584755/Cloud_computing_services_guidance_Jan_2017.pdf), accessed 31<sup>st</sup> March 2018.
- 1 For a range of examples, see <https://edtechmagazine.com/k12/article/2016/01/schools-tap-big-data-understand-trends>; <https://edtechnology.co.uk/Article/how-data-analytics-can-help-schools-and-unis-foster-growth>; <https://medium.com/@LloydMarino/schooling-big-data-how-data-analytics-help-teachers-schools-6ce69f31425c>; <https://www.indiatoday.in/education-today/featurephilia/story/big-data-in-school-education-964809-2017-03-09>, accessed 31<sup>st</sup> March 2018.

- 1 Thomason, J. (2017) 7 ways to use blockchain for international development, <https://www.devex.com/news/opinion-7-ways-to-use-blockchain-for-international-development-90839>, accessed 31<sup>st</sup> March 2018.
- 1 Bloomberg, J. (2017) Eight reasons to be sceptical about Blockchain, <https://www.forbes.com/sites/jasonbloomberg/2017/05/31/eight-reasons-to-be-skeptical-about-blockchain/#38ec22e5eb19>, accessed 31<sup>st</sup> March 2018.
- 1 Ford, P. (2018) Bitcoin is ridiculous. Blockchain is dangerous, *Bloomberg Businessweek*, <https://www.bloomberg.com/news/features/2018-03-09/bitcoin-is-ridiculous-blockchain-is-dangerous-paul-ford>, accessed 31<sup>st</sup> March 2018.
- 1 Babu, S. (2018) Of scams, 'audit fatigue' and the blockchain, *Medium*, 15 February, <https://medium.com/@sbabu/of-scams-audit-fatigue-and-the-blockchain-7d42d3b39f1>, accessed 31<sup>st</sup> March 2018.
- 1 This sub-section draws heavily on the consultations and evidence explored in Unwin, T., Weber, M., Brugha, M. and Hollow, D. (2017) *The Future of Learning and Technology in Deprived Contexts*, London: Save the Children International, <https://resourcecentre.savethechildren.net/library/future-learning-and-technology-deprived-contexts>, accessed 30<sup>th</sup> January 2018.
- 1 Chin, J. and Lin, L. (2017) China's all-seeing surveillance state is reading its citizens' faces, *The Wall Street Journal*, <https://www.wsj.com/articles/the-all-seeing-surveillance-state-feared-in-the-west-is-a-reality-in-china-1498493020>, accessed 28<sup>th</sup> May 2018.
- 1 Again, this draws heavily on Unwin, T., Weber, M., Brugha, M. and Hollow, D. (2017) *The Future of Learning and Technology in Deprived Contexts*, London: Save the Children International, <https://resourcecentre.savethechildren.net/library/future-learning-and-technology-deprived-contexts>, accessed 30<sup>th</sup> January 2018.
- 1 War Child (2013) *Education: Quality Learning Opportunities for Children Affected by Armed Conflict*. Amsterdam: War Child, [https://www.warchildholland.org/sites/default/files/bijlagen/node\\_2305/19-2014/education\\_brochure\\_for\\_online\\_low\\_resolution.pdf](https://www.warchildholland.org/sites/default/files/bijlagen/node_2305/19-2014/education_brochure_for_online_low_resolution.pdf); War Child (no date) *How War Child uses Media and IT*, Amsterdam: War Child, [https://www.warchildholland.org/sites/default/files/bijlagen/node\\_2305/11-2013/3912.1001\\_infographic\\_war\\_child\\_6.pdf](https://www.warchildholland.org/sites/default/files/bijlagen/node_2305/11-2013/3912.1001_infographic_war_child_6.pdf), both accessed 23 August 2017.
- 1 ILO, The future of work, <http://www.ilo.org/global/topics/future-of-work/lang-en/index.htm>, accessed 10<sup>th</sup> April 2018.
- 1 It is remarkable how willing people are to give their data away for free, and yet everyone should know that such data are mined for profit. See, Sky News (2018) Mark Zuckerberg accepts blame for Facebook data handling before Congress appearance, <https://news.sky.com/story/mark-zuckerberg-accepts-blame-for-facebook-data-handling-before-congress-appearance-11324724>, 10<sup>th</sup> April 2018.

### 5.3 The implications of emerging technologies on education in the longer term

- 1 Hamzelou, J. (2017) Brain implant boosts human memory by mimicking how we learn, *New Scientist*, 13 November 2017, <https://www.newscientist.com/article/2153034-brain-implant-boosts-human-memory-by-mimicking-how-we-learn/>, accessed 10<sup>th</sup> April 2018.



- 1 Wilson, M. (2017) Innovations in mobile birth registration: insights from Tanzania and Pakistan, GSMA, <https://www.gsma.com/mobilefordevelopment/programme/digital-identity/innovations-in-mobile-birth-registration-insights-from-tanzania-and-pakistan/>, accessed 10<sup>th</sup> April 2018.
- 1 Cox, J. (2017) US company becomes first to microchip employees, *Independent*, <https://www.independent.co.uk/news/business/news/us-tech-company-microchip-employees-first-three-square-market-wisconsin-a7856971.html>, accessed 10<sup>th</sup> January 2018.
- 1 Yu, D. and Deng, L. (2014) *Automated Speech Recognition: a Deep Learning Approach*, New York: Springer.
- 1 I am particularly grateful to Ettie Unwin, Jeremy Minton, and Daryl Rodrigo, all young computer scientists, engineers and mathematicians, for helping me formulate some of these ideas.
- 1 See for example the past work of the haptics group at the University of Pennsylvania led by Katherine Kuchenbecker, <http://haptics.seas.upenn.edu/>, who is now Director of the Haptic Intelligence Department at the Max Planck Institute for Intelligent Systems, <https://hi.is.mpg.de/~kjk>, both accessed 10<sup>th</sup> April 2018.
- 1 <https://today.yougov.com/news/2017/10/02/1-4-men-would-consider-having-sex-robot/>, accessed 10<sup>th</sup> April 2018.
- 1 <https://www.theguardian.com/technology/2017/apr/27/race-to-build-world-first-sex-robot>, accessed 10<sup>th</sup> April 2018.
- 1 Finland's basic income for everyone gives a glimpse of what may be to come. See, Schulze, E. (2018) One year on: is Finland's free money experiment working?, <https://www.cnbc.com/2018/01/01/one-year-on-finland-universal-basic-income-experiment.html>, accessed 10<sup>th</sup> April 2018.
- 1 See, for example, <https://www.perrymarshall.com/2002/opium-of-the-people/>, <https://altered-states.net/barry/newsletter260/tv.htm>, [https://www.huffingtonpost.com/dr-jim-taylor/technology-addiction\\_b\\_2040298.html](https://www.huffingtonpost.com/dr-jim-taylor/technology-addiction_b_2040298.html), all accessed 10<sup>th</sup> April 2018.
- 1 For a wider discussion of scientism, see Habermas, J. (1978) *Knowledge and Human Interests*, London: Heinemann, 2<sup>nd</sup> edition, and Unwin, T. (2017) *Reclaiming Information and Communication Technologies for Development*, Oxford: Oxford University Press.

## 5.4 What will happen, and what should happen?

- 1 Data from the World Bank, <https://data.worldbank.org/indicator/MS.MIL.XPND.GD.ZS?page>, accessed 10<sup>th</sup> April 2018.
- 1 As an example, in 2016, DFID announced that it was going to spend £19.9 million over 8 years to form a “what works” evidence hub to answer key questions about the use of education technology to improve learning for all (<https://supplierportal.dfid.gov.uk/selfservice/pages/public/viewPublicNotice.cmd?bm90aWNISWQ9Njc3MjA%3D>, accessed 10<sup>th</sup> April 2018). If such money had instead been focused primarily on ensuring that what is already known is shared more effectively and implemented more wisely, then it would be likely to have

much greater impact. Such initiatives are much more likely to benefit researchers in the richer countries of the world than they are to have any real impact on the learning futures of children in poor countries and deprived areas.

## 6. Concluding recommendations: how UNICEF can make a difference with the use of ICTs for education

- <sup>1</sup> UNICEF (2017) *Children in a Digital World*, [https://www.unicef.org/publications/files/SOWC\\_2017\\_ENG\\_WEB.pdf](https://www.unicef.org/publications/files/SOWC_2017_ENG_WEB.pdf), accessed 9<sup>th</sup> January 2018.
- <sup>1</sup> Unwin, T., Weber, M., Brugha, M. and Hollow, D. (2017) *The Future of Learning and Technology in Deprived Contexts*, London: Save the Children International, <https://resourcecentre.savethechildren.net/library/future-learning-and-technology-deprived-contexts>, accessed 30<sup>th</sup> January 2018.