A SHORT GUIDE ON THE USE OF TECHNOLOGY FOR LEARNING

PERSPECTIVES AND TOOLKIT FOR DISCUSSION

B. Haßler, L. Major, P. Warwick, S. Watson, S. Hennessy, B. Nicholl
FACULTY OF EDUCATION, UNIVERSITY OF CAMBRIDGE

Executive Summary

An effective, high-quality education system is of central societal importance. Educational institutions are embedded in society, and educational practice is shaped by various factors, including norms and values, government policy, the overall availability of resources (including content and technology), as well as research evidence for effective teaching and learning.

For several decades, advances in digital technology have led to an increased interest in considering its potential applications in the education sector. More recently, the increased affordability of low-cost mobile technology has sparked intense interest and experimentation in the classroom. This experimentation is often characterised by a specific narrow focus (for example, on the technology itself), rather than considering: (i) the wider connections between technology and pedagogy; (ii) what constitutes effective technology-enabled learning environments for children (in the classroom); (iii) corresponding teacher professional development opportunities.

This short guide provides an overview of the our full report "Perspectives on technology, resources and learning". We offer six wider perspectives on the interaction between technology, pedagogy, and educational resources. **The implementation of technology in the classroom** cannot be seen as a one-off process, and a pragmatic Design/Engineering-Based Research approach offers a means of iteratively developing robust designs that can be sustainably implemented in classrooms. **Lessons for the successful introduction of technology in schools** include technology management and appropriate infrastructure. Holistic strategies for integrating digital and nondigital resources are needed, and teacher professional development (TPD) needs to be aligned with a shared vision across all stakeholders. Indeed, pedagogical practice is not an outcome of technology use, and does not simply change as a result of introducing new technology. **Pedagogic spaces must be opened up** to promote student dialogue, collaboration and problem-solving activities. This can be supported by a broad range of hardware and software used in conjunction with nondigital tools and resources.

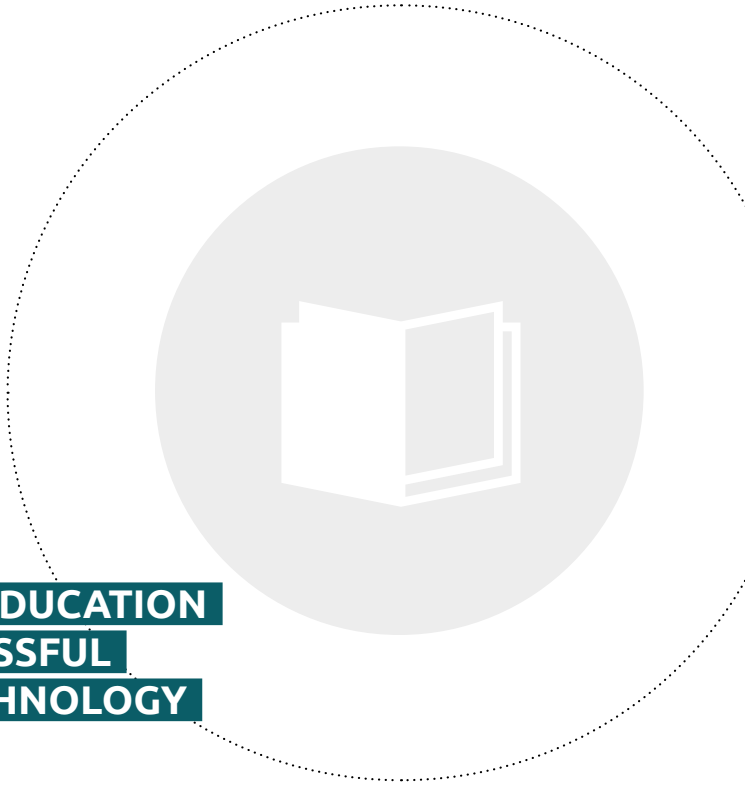
The teacher and teacher education are central for the successful integration of digital technology into the classroom. Pre-service and in-service education, including lifelong learning, needs to build in technology experiences, with a view to developing the knowledge and confidence of teachers. In relation to the use of **mobile technology in international development**, many ICT-based education projects still have a narrow focus on hardware and software. Educational research shows that resource-based interventions alone have limited impact on student learning, and that technology in itself does not add value to education. As with more developed educational systems, interventions that combine resource-based interventions and teacher development stand the best chance of success. In many low-resourced countries, teachers urgently need more effective opportunities for professional development in order to meet children's need for better education. Children urgently need

more effective teachers, not more gadgets in the classroom, particularly when funding and resources are limited. **Educational content** needs to be (culturally) appropriate for students and student learning, for instance with regard to the curriculum and teachers' pedagogies. Content must also support teachers and, where needed, include content for teacher development programmes. To ensure sustainability and scalability, content should be freely available, as Creative Commons-licensed Open Educational Resources (OER).

The aim of the report is to build bridges between technology industries and recent educational research evidence, with a view to supporting the development of more effective, technology-enabled learning to which both educators and technologists can aspire. We consider the connections between technology and pedagogy, with a particular focus on what constitutes effective technology-enabled learning environments for children (in the classroom), and corresponding TPD opportunities.

Each of the six perspectives outlined above draws on key messages from rigorous educational research, including landmark literature reviews, enriched with examples based on the authors' personal experiences. We note that the overall evidence suggests that education outcomes are not about the technology itself, but instead, about *how* technology is used. Key messages emerging from the research literature provide a basis on which pedagogical innovation can inform future directions, and ultimately lead to higher quality learning outcomes. To future-proof the perspectives provided in this report, we conclude with a toolkit for discussion.

The full report is available at http://tiny.cc/perspectives.



THE TEACHER AND TEACHER EDUCATION ARE CENTRAL FOR THE SUCCESSFUL INTEGRATION OF DIGITAL TECHNOLOGY INTO THE CLASSROOM.

Key points from the perspectives

Perspective 1 – Implementing technology in the classroom: a blueprint for a pragmatic engineering approach to research and development

- The impact of technology in schools has often been limited as a result of reformers not fully appreciating the nature of appropriate pedagogy and teaching practices.
- Design-Based Research (DBR) is a research and development approach that involves the iterative development of robust designs that can be sustainably implemented in classrooms.
- Engineering-Based Research (EBR) is a variant of DBR concerned with systemic change (for instance, classroom practices, systems and structures). EBR provides an excellent methodological solution for collaborative design and development involving schools, researchers and technology.

Perspective 2 – Lessons for the successful introduction of technology in schools: technology management, appropriate infrastructure and overcoming other barriers

- Technology is most effective when there is an holistic strategy to integrate digital and nondigital resources; the school's infrastructure needs to facilitate the use of the technology being introduced.
- A number of school-level barriers can impede the successful integration of technologies. Teacher Professional Development (TPD) that is aligned to a vision shared among all stakeholders and encouraged at all levels is most likely to be successful in overcoming such obstacles.
- Interactive pedagogy is not an outcome of technology use, and does not simply change as a result of the introduction of new technology. Instead, the power of using technology in the classroom relies on the premise that it is integrated into existing pedagogy.

Perspective 3 – Opening up a pedagogic space to promote student dialogue and collaboration: moving beyond the affordances of hardware to enhance learning outcomes

- Enabling teachers to make strong connections between their pedagogy and their intended use of technology in the classroom has a powerful impact on the way in which these technologies are used for students' learning.
- One challenge for producers of computing hardware and software is to envisage relevant problem-solving activities for materials that set activities in a meaningful context for students.
- A focus on curriculum subject learning alone, without due consideration of how collaboration,

problem solving and dialogue develop students as learners, is likely to lead to technology use that does not necessarily improve learning outcomes.

- Some of the most interesting, and arguably effective, examples of educational technology use in schools do not focus on the use of a single application, but use a broader range of hardware and software in conjunction with nondigital tools and resources.

Perspective 4 – The central role of teacher education for the successful integration of digital technology into the classroom

- Teachers' adoption of technology is influenced by the quantity, and quality, of pre-service technology experiences. Teacher education programmes should not simply focus on how to use technology, but should instead address how technology can be used for teaching and learning.
- In-service TPD prepares teachers to be able to develop, adapt and deliver appropriate curricula that promote learner progress. Without appropriate TPD, genuine pedagogical transformation facilitated by technology is unlikely to occur.
- Effective TPD, which forms a continuum from pre-service to in-service and lifelong professional learning, requires an integration of discipline expertise, pedagogical expertise and ICT competence.

Perspective 5 – Mobile technology and international development

- Many ICT-based international development education projects have a narrow focus on hardware and software.
- Education research shows that resource-based ("access") interventions alone have limited impact: technology in itself does not add value to education.
- Children, particularly disadvantaged children, urgently need better teachers. Given limited funding and the need for equitable access, resources need to be focused on what works (interactive teaching practices and TPD).

Perspective 6 – The role of educational content

- Content needs to be appropriate for students and student learning (in terms of culture, curriculum and pedagogy).
- Content needs to support teachers (content provides classroom use cases; content includes materials for school-based teacher development activities).
- To ensure equity, sustainability and scalability, content should be open (Creative Commons-licensed).

Toolkit for discussion

Technology, Resources and Learning: Productive Classroom Practices and Effective Teacher Professional Development

1. **Exactly how will the technology use contribute to improved learning outcomes?**
    - Is the technology provided to teachers simply as a resource without details of classroom use?
    - Is the (explicit or implicit) assumption that technology itself will transform learning ('technological determinism')?
    - Is there a credible theory of change, rooted in experience and education research outcomes, that suggests precisely how technology-related activities lead to better learning outcomes?

2. **Is the proposed technology use (hardware, software and content) aligned with (a) the curriculum (including content, skills and overall goals) and (b) effective classroom practice?**
    - Does the technology use promote students' dialogic skills, collaborative learning and metacognition?
    - Is the scenario one of individual e-learning (supervised by teachers) or is shared use envisaged (in conjunction with teaching practices such as dialogue and collaborative learning)?
    - Are the classroom scenarios detailed and credible (with appropriate, curriculum-linked resources)?
    - Is the assumption that teachers will create this alignment between the curriculum and practice themselves (without guidance); if not, how much guidance is provided?

3. **Is the technology provided through a one-off intervention (without trialling)?**
    - Or, does the intervention envisage iterative cycles of engagement with teachers, children and other stakeholders?

4. **How will change over time be measured?**
    - Where within SAMR is the intervention positioned?
    - How realistic is this positioning? To what extent is the positioning supported by the overall theory of change (based on research outcomes)?
    - What are the baseline levels of participating teachers' knowledge, skill and attitudes — and of student knowledge?
    - How will learning gains be measured and is there any comparison group? Can observed change be attributed to the intervention?

5. **What provision is made for effective teacher professional development (TPD)?**
    - Does the initiative focus primarily on resources for the classroom (such as infrastructure, physical resources, books, computers, more classrooms, more teachers), or is provision for TPD also made?
    - What is the nature of the TPD?
    - Is there a credible approach to professional development (long-term; focussing on ICT-enabled subject pedagogy), or a simplistic ICT training for teachers (short, one-off workshops)?
    - How will enough time be made available for teachers to participate in a sustained way?
    - How motivated are they to do so?
    - Is there provision for certification?

6. **Is the particular technology suitable for the purpose and the context?**
    - For instance, is battery life adequate for deployment in rural areas with little power or connectivity, or have solar powered options been considered?
    - What assumptions are made about Internet connectivity?
    - Is the number of devices appropriate for the class size? Is shared use envisaged (in order to reach more students and classes)? Where technology resources are limited, has a rota been drawn up?
    - What is the setting in which the content is used (that is, formal vs. informal education or both)?

7. **Does the technology use focus on equitable access to learning, or does it focus on "easy-to-reach first"?**
    - How will the technology reach and support teachers and pupils in deep rural areas (without access to power, mobile internet or even mobile signal)?
    - How will the technology reach and support female teachers and female pupils?
    - Is provision made for the inclusion of all teachers and pupils, including those who have special learning needs?
    - How are the devices used (device–pupil ratio; 1:1 or shared use)?

8. **How scalable and sustainable is the intervention?**
    - Is all educational content published as Open Education Resources?
    - Is the software open source or are (paid or free) licences required?
    - Is all content and software easily downloadable? Or is access impeded by high bandwidth requirements, poor formatting and registration?
    - Are reports published regularly, offering rigorous insights and critical reflection?

B. Haßler, L. Major, P. Warwick, S. Watson, S. Hennessy, B. Nicholl (2016).
A Short Guide on the Use of Technology for Learning: Perspectives and Toolkit for Discussion.
Faculty of Education, University of Cambridge. April 2016.

Available from http://tiny.cc/perspectives.

This report was commissioned by ARM, www.arm.com.

Acknowledgements. The following icons from the https://thenounproject.com/ were used under CC BY 3.0 US, http://creativecommons.org/licenses/by/3.0/us/:

Group, by Anton Scherbik, UA, https://thenounproject.com/term/group/118487;
Mobile Rotate, by artworkbean, ID, https://thenounproject.com/term/mobile-rotate/124260;
Leaf, by BenPixels, https://thenounproject.com/term/lead/190309;
Book, by Pham Thi Dieu Linh, VN, https://thenounproject.com/term/book/251052;
Mouse, by Castor & Pollux, FR, https://thenounproject.com/term/mouse/35151;
Laptop, by Dara Ullrich, DE, https://thenounproject.com/term/laptop/6847;
Mobile Upload, by Thomas Helbig, DE, https://thenounproject.com/term/mobile/158391.
Microscope, https://thenounproject.com/term/microscope/648, is CC0 / Public Domain.

www.educ.cam.ac.uk