DFID Educational Technology Topic Guide 'At a Glance' Summary

INTRODUCTION

There is enormous interest and investment in the potential of educational technology (edtech) to improve the quality of teaching and learning in low and lower-middle income countries. The primary aim of the Topic Guide is to contribute to what is known about the relationship between edtech and educational outcomes. Taking evidence from over 80 studies, the guide addresses the overarching question: **What is the evidence that the use of edtech, by teachers or students, impacts teaching and learning practices, or learning outcomes?** It also offers recommendations to strengthen the design, implementation and evaluation of programmes that use edtech.

Methodology

The research involved three distinct stages:

- an online literature search identifying 83 studies (45 research documents, 20 literature reviews and 18 grey literature reports) on edtech use in schools in select low and lower-middle income countries
- an appraisal process, against DFID's agreed criteria (including transparency, rigour, validity), to identify key findings and rate the quality of the evidence
- a written analysis addressing the overarching and subsidiary research questions

Definition: What is edtech?

Definitions of edtech are contested and changing, but for the purposes of the guide, and in line with emerging DFID policy, edtech is defined as **the use of digital or electronic technologies and materials to support teaching and learning.** Implicit within this definition is the recognition that:

> *"Technology of itself doesn't enhance learning! It depends how the technology is designed and implemented; how teachers are supported to use it; how outcomes are measured; what communities are in place to support it."*
> *(http://tel.ac.uk/about-3/, 2014)*

FINDINGS

Use of edtech among reviewed studies

These findings come from a wide range of technology use including:

- interactive radio instruction (IRI)
- classroom audio or video resources accessed via teachers' mobile phones
- student tablets and eReaders
- computer-assisted learning (CAL) to supplement classroom teaching
- computer suites
- one laptop per child

For the purpose of the guide, edtech use by teachers (e.g. IRI, where the teacher uses technology in class) and edtech use by students (e.g. CAL or eReaders, where the students have hands-on access to technology) is distinguished.

Examples of effective edtech programmes

It is now widely acknowledged that, while the Millennium Development Goals prompted improvements in access to education, the Sustainable Development Goals address the challenge of quality. This issue is also reflected in edtech programmes. Reports of programmes that move beyond access to technology (both in programme design and evaluation) are emerging, but as yet relatively few programme evaluations focus on adequately capturing improvements in the teaching and learning process or measuring improvements in learning outcomes. The findings below are drawn from those that do.

The following uses of edtech by teachers were associated with positive changes in learning outcomes and classroom practice:

Interactive radio instruction (IRI)

Several studies reported positive impacts on learning outcomes from IRI, particularly with early primary students. A World Bank review showed average effect sizes of +0.5 (World Bank, 2005, p. 16), while a subsequent review found effect sizes ranging from

-0.16 to +2.19 (Ho & Thrukal, 2009). The variability ineffectiveness was attributed to factors including quality of programme implementation, monitoring, and local human resources. The greatest effect sizes were seen at Grade 1, suggesting IRI is particularly effective for early primary years.

Improvements in classroom practice from IRI were evidenced by two studies in which IRI was used in the context of teacher professional development. Sous le Fromager in Guinea supplemented IRI with radio programmes for school staff and face-to-face professional development to instil respectful behaviour of teachers towards students. Qualitative classroom observations suggest teachers hit students less often and allowed more time for students to develop understanding (Burns, 2006, p. 9). Similarly, an IRI programme in Mali supplemented IRI with radio-based, in-service training. Systematic classroom observations showed year- on-year improvements in the percentage of observed lessons demonstrating select classroom practices (e.g. brainstorming, group work, total physical response) (Ho & Thrukal, 2009, p. 10).

Mobiles for classroom audio and teacher development videos.

Several studies arising from one programme (English in Action [EIA], Bangladesh) reported positive impacts from mobile use on English language teaching (ELT) practices and student learning outcomes. EIA is primarily a teacher development (TD) programme. The approach has some similarities to IRI, in that mobile phones provide access to audio resources for classroom use, particularly for primary teachers. Mobiles are also used to provide access to TD materials, including videos of classroom practice, which underpin the programme. Materials are not broadcast, or downloaded, but provided as a library of digital resources, on a small memory card.

Several large-scale systematic observations of classroom practice (EIA, 2011b, 2012b, 2014b) showed significant increases in students' talk time (including talk in pairs and groups), and students' and teachers' use of English (the target language), compared with baseline studies (EIA, 2009). Associated improvements in student learning outcomes were also evidenced, most recently with 35% more primary students achieving Grade 1 or above, and 20% more primary achieving Grade 2 or above, on recognized international frameworks of English language competence (Graded Examinations in Spoken English (GESE), Trinity College London, 2013, which map onto the Common European Framework of Reference, Trinity College London, 2007, EIA, 2014b).

Mobiles for classroom video.

The BridgeIT programme (India and Tanzania) provided evidence of improved learning outcomes from teachers' use of smartphones to play video lessons for their classes via flat-screen TVs or data-projectors. Teachers also had activity guides to support or extend the video lessons. In Tanzania, students showed average gains of 10–20% over control groups for maths and science. However, while some groups of students excelled, others showed modest gains if any (Enge, 2011). In India, there were average gains of 10% over control groups for science, but no gains for English (Wennerstan & Qureshy, 2012). BridgeIT also carried out systematic classroom observations pre- and post-intervention in India. These showed a 31% increase in the proportion of lessons identified as 'high quality', with a corresponding 24% drop in the proportion of (traditional) 'direct instruction' lessons (Wennerstan & Qureshy, 2012, p. 32).

Among the studies reviewed, the strongest evidence of changes in learning outcomes and classroom practice came from the use of mobile devices (such as eReaders) and CAL programmes to support improvement in mathematics:

eReaders and tablets to support early literacy.

Several programmes presented evidence of improved learning outcomes (in terms of increased reading fluency in the mother tongue or English) that combined provision of eReaders and eBooks for students with TD programmes on phonics-based literacy instruction (Worldreader, 2012, 2013; Murz, 2011; USAID, 2013; PRIMR, 2013).

Remedial CAL programmes in mathematics.

Although CAL programmes in maths as a replacement for regular teaching were found to have limited impact (Banerjee et al., 2007, p. 1,240) or lower learning outcomes (Linden, 2008, p. 26), there is some evidence of improved learning outcomes from remedial CAL programmes as supplements for under-privileged students (Banerjee et al., 2007, p. 1,238) or under-performing students (Lai et al., 2011).

In addition, several studies presented evidence of students working more independently and collaboratively using online or offline digital resources to support project work. This was usually in the context of a teacher development

programme, with clear curricular and pedagogic focus (for example: Light, 2009; Were et al., 2009; Leach et al., 2005). In two studies, students expressed a view that group work was better than individual work with a computer, as peer learning was valued. Young students suggested an optimum group size of three, four (Haßler,et al., 2011, p. 42) or five (Leach, 2008, p. 20).

The effective edtech programmes described above are characterized by:

- a **clear and specific curriculum focus** (e.g. communicative language learning, early literacy or remedial mathematics)
- the use of **relevant curriculum materials** (classroom audio, video, eBooks, research resources, radio programmes)
- a **focus on teacher development and pedagogy**
- **evaluation mechanisms that go beyond outputs** to look at outcomes in terms of changes in teaching and learning practices, or learning outcomes.

Finally, while value for money (VFM) analysis is non-existent in most studies, the PRIMR study stands out for its strong focus on cost-effectiveness. The programme in Kenya implemented and compared the effectiveness of three different interventions – tablets for tutors (teacher educators), tablets for teachers, and eReaders for students. Similar gains in student learning outcomes were shown for all three treatments, with no statistically significant difference between treatment groups (Piper & Kwayumba, 2014, p. 2). Further analysis showed that, while the outcomes were similar, the costs for teacher or tutor tablets were much lower than for class sets of eReaders, making the cost-effectiveness of teacher or tutor tablets an order of magnitude greater (Piper & Kwayumba, 2014, p. 3).

Examples of less effective uses of edtech

Among the studies reviewed, 21 reported on students' use of computers, but very few of these presented evidence of measurable improvements in learning outcomes. Three that did were CAL programmes in maths, as discussed above.

Several studies showed that increasing students' access to computers of itself has little discernible impact on teaching or learning practices. For example:

- 'computers are often not used for teaching and learning purposes' (EdQual, 2011, p. 3)
- while 98% of publicly supported schools in Chile have increased access, 'ICT is not frequently used at school' (Hinostroza et al., 2011, p. 1,360)
- although NEPAD provided schools with 20 suites of desktop computers, satellite connectivity, wireless networks, smartboards, and health software, 'teachers are not in general using the Healthpoint software for purposes of health promotion' (Rubagiza et al., 2011, p. 42)
- in Myanmar, 33,497 schools were provided with ICT facilities in 2009, but evaluation showed 'the frequency of use of ICT for teaching and learning was considered to be very low' (UNESCO, 2013a, p.45)
- despite increasing student-computer ratios in Peru, the One Laptop per Child (OLPC) programme 'did not seem to have affected the quality of instruction in the class…a substantial share of laptop use was directed to activities that might have little effect on educational outcomes' (Cristia et al., 2012, p. 3).

These examples illustrate that even the most substantial investment in edtech can have limited impact. A common explanation for this is that:

> *"Provision of ICT in schools is only the first step. For ICTs to become a tool for improving teaching and learning…they need to be supplemented by teacher professional development."*
> (Edqual, 2011, p. 12)

There is scant evidence of this being done successfully (for example: Light, 2009; Were et al., 2009; Leach et al., 2005). More broadly, across the studies reviewed, detailed accounts of how edtech is used in classrooms are very rare. Relatively few studies examine classroom practice beyond teacher self-reporting.

RECOMMENDATIONS

Edtech programmes should:

- focus on enabling educational change, with an emphasis on curriculum, pedagogy, teaching and learning, not on technology
- provide adequate support to enable implementation of change in classrooms and schools (see for example, Westbrook et al., 2013)
- develop systematic monitoring and evaluation procedures, that capture changes in teaching and learning practices and learning outcomes, as well as participants' experiences and perspectives.

Proposals should be encouraged that:

- further explore and develop practices for which there is evidence of a positive impact on teaching and learning
- address gaps in evidence including:
  - effective approaches to teacher development that enable improved teaching and learning practices with edtech;
  - understanding how such practices are enacted, and in what contexts, at school and classroom level.

Proposals that have an emphasis on technology over education, that have weak teacher support or poor evaluation, should be discouraged.

Power, T., Gater, R., Grant, C., and Winters, N. (2014). Educational Technology Topic Guide. Technical report, Health and Education Advice and Resource Team (HEART), Department for International Development (DFID), London, UK., available at: http://www.heart-resources.org/topic/educational-technology/

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ENGLISH in ACTION

English in Action programme produced this extract from the executive summary of the original topic guide.

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