ICT and Educational Performance

Do national results point in the same direction? The role of research reviews and assessment studies

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Introduction and definitions

In order to answer the question posed in the title – Do national results point in the same direction with regard to ICT and educational performance? – this paper addresses three aspects of the question and its subtitle. First, are all national results measuring the same phenomenon? Second, do they point in the same direction? Third, what are the methodologies and methods being used to reach the various results and conclusions? In order to contain the scope of the paper and thus to try to make some sense of the range of data available in the sub-field, I will concentrate on one aspect of educational performance: literacy.

As a preliminary to discussion of the main parts of the paper, however, some clarification is needed. In limiting the aperture of the paper to *literacy*, the simple definition of that term is the following: the ability to understand and create written language. It is, however, frequently defined in two broader senses, and both are embraced in the present paper. Firstly, the scope can be expanded so that written language becomes written language and graphical and/or pictorial (multimodal) representation. Secondly, the skill can be treated as social, rather than psychological; in this view, literacy is the ability to operate a series of social or cultural representations. Since sets of expectations and norms differ depending on the situation, the social view of literacy entails a number of different 'literacies'.

The paper excludes, however, discussion of 'information literacy' or other forms of literacy where the term is used metaphorically to mean 'competence'. It is particularly important in a paper on information and communication or digital technologies on the one hand, and literacy on the other, to make it clear that the emphasis is not on information literacy.

By *national results* the paper takes a broad approach. Such results can be placed on a spectrum from the results of evaluations by national agencies and/or national assessment systems at one end, to the results of independent national and international research reviews and assessment studies at the other. There is a certain scale and rigour about the term 'national results': it assumes large-scale evaluation of one sort or another; and, importantly, it assumes 'results' deriving from a systematic and rigorous form of inquiry, rather than the looser term 'findings' which suggest tentative, exploratory and/or provisional results. It must be added, however, that the

data in which we are interested in this paper can be in quantitative and/or qualitative form.

Are all national results measuring the same phenomenon?

To begin to answer this question, I draw on studies in the last six years or so from England and the USA, and also on the international PISA assessments of 2003.

Six international systematic research reviews were undertaken by the English Review Group (UK) between 2001 and 2004: five of these were for the government-funded Department for Education and Skills through EPPI-Centre between 2001 and 2003 (all five are collected in Andrews 2004); and a further study was commissioned from the group by the Teacher Training Agency (not published by the Agency, but subsequently reported in Andrews et al. 2007b) [1]. All six reviews were concerned with literacy at school levels, but with different aspects of it: four focussed on the *impact* of networked ICT on literacy, of ICT on English as a Second Language, of ICT on literature teaching, and of ICT on moving image literacy; two focussed on the *effectiveness* of ICT on literacy and on writing development for the 5-16 age range. 'Impact' was taken to be a broader term than 'effectiveness', but both assumed that an intervention was made and that its outcome could be measured. For convenience, these six reviews – all slightly different – will be called the English Review Group studies. Although the research reviewed was international in scope and in the English language, most of the research in these studies was carried out and reported in the USA. Questions have been asked of the research and its implications as to whether is transferable from country to country.

In a somewhat less rigorous review by a team of experts commissioned by the British Educational Communications and Technology Agency (Becta 2003) under the title *ICT and Pedagogy*, the focus is on English as a subject area at both primary (5-11) and secondary (11-16) levels in England. The focus of attention is less on learning outcomes than on pedagogy and on what we might broadly call 'the impact on classroom practices'. Apart from presenting (uncritically) the results of the two ImpaCT projects, which had a national scope (Watson 1993, Comber et al. 2002), the choice of research studies cited in the review seems serendipitous and not of national[2] range and coverage.

A narrower, more focussed study by Goldberg et al. (2003) looked at the effect of computers on student *writing* in the USA via a meta-analysis (an approach aiming at synthesis of statistical effect sizes), comparing student's writing on computers with their handwritten practices.

An OECD report (OECD 2006) looks at whether access to computers for students is equitable across countries and students groups; how students use ICT and what their attitudes are towards it; at the relationship between students' access to and use of ICT and their performance in PISA 2003; and at implications for educational policy. It is

[1] Both the government department and the body concerned with teacher training have sinced changed their names: to the Department for Children, Schools and Families, and the Training and Development Agency for Schools respectively.

[2] 'National' refers in the above two studies to England, which is not strictly speaking a nation.

the third of these that concerns us in the present paper. The PISA data contains information on reading performance, but not on writing.

An exploration of the What Works Clearinghouse site and the linked Campbell Collaboration site revealed an interest in both literacy at school levels and in adult literacy, but no specific reviews or assessments in the relationship between ICT and literacy development. Discussion of these sites and their approach is reserved for the section on methodology and methods, below.

An important caveat in determining whether national results measure the same phenomenon is to consider whether to include popular culture and media, including gaming, under the umbrella of information and communication technologies. The broader definition of literacy, offered above, would include such elements, widening ICT to include also mobile technologies and therefore, by implication, the use of ICT in the street and at home as well as at school. Reviews and large-scale assessment studies such as those by Marsh et al. (2005), Attewell, J. (2005), Rideout et al. (2003, 2005), Buckingham (2005) and Livingstone et al. (2005) tend to have their focus on the wider, cultural picture and on the wider definitions of literacy; most of them do not have specific results with regard to text-based reading and writing development or attainment. Typical of this approach is a summary on the National Literacy Trust's web pages of Marsh et al's study: "the introduction of popular culture, media and/or new technologies into the communications, language and literacy curriculum has a positive effect on the motivation and engagement of [0-6 year old] children in learning. Practitioners report that it has a positive impact on children's progress in speaking and listening and literacy, although the present study *did not include methods which could determine if this was the case*" [my italics].

Do the results point in the same direction?

The results of the English Review Group studies point in the same direction. They all suggest that where there is impact or effect of ICT on literacy attainment, the margin is small[3]. In many cases, there was found to be no effect or impact, and in some cases a negative effect. Such results do not make for very interesting or encouraging reading, given the huge amount of investment by the UK government in the provision of hardware and software in schools, and in the training of initial and continuing teachers.

The ImpaCT reviews, cited in the Cox et al. (2003) review are more positive about the impact of ICT on literacy development. The second review (Comber et al. 2002) sees a causal connection between improved results in reading, and less so for writing[4], since 1997 for 11 year olds and 14 year olds. These results, I think, have to be read sceptically, for at least three reasons: first, the impact or effect of ICT is not isolated from other variables or factors that could have contributed to the rise in literacy scores. Second, the claims for a rise in literacy scores themselves have been the subject of critique (Tymms 2004). Third, it is in the interests of Becta, a government agency, to see positive outcomes resulting from its work and from government

[3] A small effect size can be highly significant in education if the sample is large.
[4] The lag in writing scores behind those for reading reflects a long-standing gap in literacy results in England, irrespective of ICT.

investment in hardware, networks, software and teacher development with regard to ICT.

Another, more recent review by Becta (Cox et al. 2004) found positive effects of ICT on students' attainment, particularly in English (and in mathematics). In concert with the English Review Group systematic reviews for the EPPI-Centre, the Becta review found that a crucial component in the success of the relationship between ICT and literacy is the teacher and his or her pedagogical approaches. The impact on attainment is greatest where the ICT resources are well integrated into teachers' practices.

The Goldberg et al. (2003) meta-analysis found significant mean effect sizes in favour of computers in relation to the quantity and quality of writing; and that the writing process was more collaborative, iterative and social in computer classrooms. They suggest that the relationship between computers and quality had "strengthened considerably" since 1992. Goldberg et al. also found out that the positive results apply largely to middle school and high/secondary school pupils, and less so to primary/elementary school levels. However, it must also be taken into account that a study by Snyder (1993) has suggested that such a result is only the case for *some* school text types, like arguments and reports. For narratives, paper-and pencil/pen produced better stories and were also thought by the students to be a better medium for composition in those genres.

The PISA data shows that a number of countries were above average for performance on the PISA reading scale for all four national quartiles of the index of ICT use for a) the internet and entertainment and b) programs and software. These countries were Australia, Canada, Denmark, Finland, Germany, Iceland, Ireland, Korea, New Zealand, and Sweden, with the UK's results being also above average but with too low a response rate to ensure comparability. Little change in reading scores were noticeable between PISA 2000 and the 2003 survey (OECD 2004a).

To attempt to synthesize the results of the studies mentioned above would be difficult, if not impossible. There is certainly no possibility of statistical meta-analysis. In narrative terms, it is possible to say that the reviews and assessment studies mentioned here do tend to show a positive effect or impact of ICT, with important caveats from the English Review Group that the improvements can be small, negligible or, indeed, non-existent. There is, then, a degree of convergence between the studies, but it is not as significant as the suggestion that the relationship between ICT and literacy development is reciprocal and co-evolutionary rather than causal and one-way (i.e. the effect or impact of ICT on literacy). Such an insight has profound implications for the questions that are asked by research reviews and assessments, and also for the methodologies and methods that are employed to answer these questions.

What are the methodologies and methods being used to reach the various results and conclusions?

Even within research reviews and assessment studies, methodologies and methods can vary.

It is possible to depict a hierarchy within research reviews, with systematic (or 'explicit') international research reviews at the top because of their scope, the transparency and replicability of their method, and the minimization of bias in their procedures. The EPPI-Centre (funded by the UK government's Department for Children, Schools and Families, and by the Economic and Social Research Council) and the US-based What Works Clearinghouse (http://ies.ed.gov/ncee/wwc), linked to the now internationally-based Campbell Collaboration, provide research reviews. The WWC claims that it:

> collects, screens, and identifies studies of effectiveness of educational interventions (programs, products, practices, and policies). The WWC regularly updates the WWC Technical Standards and their application to take account of new considerations brought forth by experts and users. Such changes may result in re-appraisals of studies and/or interventions previously reviewed and rated. The current WWC Standards offer guidance for those planning or carrying out studies, not only in the design considerations but the analysis and reporting stages as well. The WWC Standards, however, may not pertain to every situation, context, or purpose of a study and will evolve.

Next down the hierarchy come research reviews by expert groups. These may not use systematic research review methodology, but the presence of more than one expert gives the review a degree of credibility. Next down would be an expert review by a single expert, subject to the biases of value system, experience and methodological approach that the particular expert brings with him or her.

Assessment studies can also take various forms, but do not present themselves so hierarchically. One could posit a number of ideal assessment studies: one would look something like an OECD review of the educational research infrastructure in a nation, like the reviews of New Zealand (2001), England (2002), Denmark (2004b), Mexico (2004c) and Switzerland (2007). However, these reviews are principally of processes and procedures, not of outcomes or of the relationship between ICT and education performance. Another ideal would be the Fullan reports on the National Literacy Strategy in England (Earl et al., 2000, 2001, 2003; Fullan 1999, 2003) which involved an external evaluation by an expert team from the Ontario Institute for Studies in Education. A third would be PISA studies, which gather data from a number of countries based on a common protocol.

Whatever the quality and methodological nature of the research review or assessment study, the methods employed by primary, secondary or tertiary ('reviews of reviews') research need to be appropriate to the question or questions being asked. To say this may seem like stating the obvious. But many studies adopt a certain methodology and method without providing a rationale. Debates – indeed 'paradigm wars' – about the virtues of qualitative versus quantitative methods are missing the point on two counts: first, these are not methods *per se*, but ways of analysing particular types of data (basically, in words and numbers respectively). Second, few studies would wish not to include both qualitative and quantitative data as evidence, as well as images and other kinds of evidence (usually coming under the qualitative heading). Goldberg et al. (2003), for example, while principally conducting a meta-analysis of quantitative data, acknowledge that their own analysis of the qualitative data in the included and excluded studies in their review came up with mutually supporting results. In short, we need all the kinds of data that will help us answer the questions we are asking.

The point made at the end of the previous section on results – *viz*, that the best area for future research on the relationship between ICT and literacy development and attainment might be on the way that they interact – has considerable implications for methodology and methods. Experimental studies have tended to work within a causal paradigm. Meta-analyses are based on the results of trials that reveal effect sizes. Such an interventionist model is no longer adequate to understand and measure the relationship between ICT and literacy development/attainment. Instead, research reviews and assessment studies will need to address more complex issues of the dynamic inter-relationship of new technologies and forms of literacy, and may well need to use film, observation, ethnographic description and other as yet unimagined methods to gauge what is going on. The actual research and evaluation questions asked, along with greater consistency and clarity between different countries, need considerable attention.

Summary and conclusions

The present paper divides the title into three questions that need to be answered: a) are all national results measuring the same phenomenon? b) do the results point in the same direction? and c) what are the methodologies and methods being used?

The answer to the first question is that not all national results, nor reviews and assessments with an international dimension, are necessarily measuring the same phenomenon. In the present study, the aperture has been narrowed to look at the relationship between information and communication technologies and literacy attainment. There is no real consistency in what studies mean by 'information and communication technologies': some mean desk top or laptop 'computers' as used in classrooms. Others mean digital communication; yet others have a broader definition in which they include others kinds of hardware and media. There needs to be greater clarity and precision about the distinctions between the hardware and its deployment; the media (television, computer screens); and the modes (speech, language, writing, the visual etc) via which communication takes place. I have also noted that 'literacy' itself requires clarity about what kinds of literacy are being discussed. In the present paper, the research that has been examined has been in the English language; but literacy and literacies can and should apply to other languages too. There is also variation as to exactly what aspect of literacy is being examined.

The results from the five sets of studies - four sets of research review and/or meta-analysis (the EPPI and TTA reviews, the two Becta reviews plus the Goldberg et al meta-analysis) and one assessment study (the PISA study on reading) – do not all point in the same direction. The Becta reviews, the Goldberg et al. study and the PISA data all suggest that there is a positive correlation between the degree of ICT provision (assuming it is well mediated by teachers) and literacy performance of one kind or another. The EPPI/TTA reviews are more sceptical, and suggest the need for a new methodological approach.

Methodologically, some of the implications of the range of questions and the variety of results are as follows:

- research questions (hypotheses, problems), which are the starting point for research studies, need to be better formulated. If there is to be international comparison, these questions need to be discussed and refined fully before projects get underway.
- international bodies such at OECD/CERI might wish to conduct more secondary research reviews *and* tertiary 'reviews of reviews' in order to synthesize research results. Such reviews should follow systematic and explicit procedures so that they can be challenged, and are updatable and replicable.
- any such reviews should balance quantitative and qualitative data, using one set to interrogate the other. Where the two kinds of data are pointing in the same direction, results can be strengthened; where they are not, interrogation must take place to see where the problems lie and further refinement of the research questions and methodologies must take place.
- the results of research syntheses can be at such an abstracted distance from the realities of experience and practice in individual contexts that they appear to have no connection. It will be useful to continue to bear in mind and to illustrate the connection between practice, policy and research.
- there should be a re-consideration of the methodological approach to the study of the relationship between ICT and literacy (and, more broadly, learning, educational performance and attainment). The interventionist, causal, one-way approach now looks inadequate and not fit for purpose. As set out in Andrews and Haythornthwaite (2007), an understanding of the reciprocal, co-evolutionary relationship between ICT and literacy (or learning more generally) might be a better basis for underpinning methodologies in the field.

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