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## **Innovation in technology-enhanced assessment in the UK and the USA: future scenarios and critical considerations**

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This paper uses methods derived from the field of futures studies to explore the future of technology-enhanced assessment. Drawing on interviews and consultation activities with experts, the paper aims to discuss the conditions that can impede or foster ‘innovation’ in assessment and education more broadly. Through a review of relevant research, the paper suggests an interpretive model of the factors sustaining the conservatism of educational assessment: the utilitarian view of education, dominant beliefs about academic excellence, and market or quasi-market dynamics. In the central section of the paper, three scenarios of innovation in assessment are described, developed through an iterative process involving researchers, representatives from the e-assessment industry, and experts from British awarding organisations. In the final section, a critical discussion draws attention to the implications that data pervasiveness and computer-generated predictive models may have for the future of education.

**Keywords:** assessment; technology; futures; data; innovation

### **Innovation in educational assessment: where does it come from?**

Any discussion about ‘innovation’ in assessment, and in education more broadly, needs to consider where this notion originated. Innovation is first and foremost a key economic principle: a necessary condition for specific industries and for whole economies to expand and thrive. In this sense, innovation is not only concerned with technology, but also with human practice, forms of labour, managerial processes and broadly with anything that can provide some form of distinctive competitive edge. There is a body of literature that looks specifically at the dynamics of innovation from a business perspective, analysing the emergence of breakthroughs, ‘disruptive’ discontinuities or incremental evolution, and highlighting the factors that can act as enablers or barriers (Rogers, 1962; Tushman & Anderson, 1986; Utterback, 1994). Most notable among these factors are, firstly, the presence of market-like conditions; secondly, the role of technology in providing the means to remove previous barriers and limitations, and in offering the potential to deliver dramatically better performance or lower costs. The market-like conditions are universally seen as necessary to generate a climate of dynamism, and above all competition, which drives

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creativity as competitors experiment and vie with one another to satisfy consumer needs, or to engineer new ones (Utterback, 1994).

In the context of education, the word innovation is generally understood as referring to the uptake of technology-enhanced practices, underpinned by pedagogic models that favour learner-centred, ‘constructivist’ approaches that shift the focus from traditional instruction to more participatory and personalised types of learning (Kozma, 2003; Mioduser, Nachmias, Tubin, & Forkosh-Baruch, 2003). The large-scale SITES (Second Information Technology in Education Study) introduced the expression ‘emerging paradigm’ to describe those innovative practices that seemed to align with notions of learning for an information society: student-centred learning, self-directed learning, collaborative knowledge building and so forth (Law, Pelgrum, & Plomp, 2008). For reasons of scope, I shall focus in this paper only on innovation in compulsory education (formal education at the primary and secondary level), without considering the implications for other types of educational provision, such as higher education or ‘lifelong learning’. Over the last decade, a number of studies have contributed to a framework for the analysis of the ‘emerging paradigm’ in formal contexts (Law et al., 2008; Zhao & Frank, 2003). Consistent with the economic view of innovation described above, this literature emphasises the role of rational, benefit-maximising behaviours, enhanced by systemic conditions that increase freedom and reward risk-taking. These studies tend to suggest that the diffusion of innovative teaching and learning is a matter of making the right choices in all layers of a ‘system’: from the broad political level to the school level, in order to enable ‘end-user innovators’, mainly teachers but also learners, to turn potential into reality (see also von Hippel, 1986). As Zhao and Frank reasoned:

When teachers are given the opportunity and resources to experiment with computers, they may improve their technology proficiency and see how computers further their goals, that is, reduce perceived costs and increase perceived benefits. (Zhao & Frank, 2003, p. 817)

Within this framework, the resistance to change of assessment regimes is often seen as a prime cause for concern. Assessment policies and accountability frameworks defined at the macro level are said to have repercussions across whole systems, ultimately shaping – mostly in negative and limiting fashions – individual pedagogic strategies at the classroom level. More specifically, high-stakes summative examinations have been criticised for dominating accountability landscapes (Daugherty, 1995), for constraining teacher practice and, ultimately, for having negative effects on students’ learning (Boud, 1995; Harlen & Deakin-Crick, 2002; McAdie & Dawson, 2006). Even in countries where technological provision in education has reached remarkable levels, and where teachers are relatively familiar with ‘progressive’ pedagogies, the common narrative is that of resources not used to their full potential, and of educators which are not ‘free agents’, but are instead subjected to many constraints which have a great influence on their practice and their relationships with learners (Bowman, 2004; Chaptal, 2002).

Consistent with the broad definition of educational innovation in formal contexts introduced above, assessment innovation is understood here as the introduction of technologies, practices and frameworks that may support progressive pedagogies, and may allow educators to take into consideration more sophisticated forms of evidence than basic attainment in tests and exams. For instance, the successful

integration of summative and formative functions of assessment can be seen as a form of assessment innovation (Black & Wiliam, 2005).

Moving on from this interpretation of innovation – in assessment and in education more broadly – the original project described in this paper set out to consult experts and practitioners in order to outline the systemic challenges and opportunities that lie ahead.

In this paper, I will summarise the study and its findings but I shall shift the focus to a number of more critical considerations which can be summarised as follows:

- (a) What are the broad cultural and economic factors that could be argued to sustain the conservatism of assessment in compulsory education?
- (b) How can the hiatus between aspirations of transformation and the enduring reality of assessment regimes be explored and possibly understood?
- (c) How can a more critical and reflective discussion about the future of education in the twenty-first century and its need to ‘innovate’ be articulated?

### **Innovation in assessment: a critical perspective**

It has become somewhat commonplace in academic and policy circles alike to claim that assessment systems legitimate outdated didactic models which encourage intellectual dependency and stifle creativity, undermining young people’s personal and social development at a very sensitive stage of their lives (Amrein & Berliner, 2002; Jones, 2007). These claims are compounded by fears that education systems in many countries, due to an emphasis on mere attainment rather than the development of complex ‘skills’, are no longer able to fulfil their function of supporting the financial well-being of individuals, as well as stimulating much-needed economic growth for entire nations (e.g. Hanushek & Woessmann, 2008). However, despite growing calls for assessment reform, it appears that current systems are in no danger of disappearing or being radically innovated. In this paper, I would like to suggest that the contradictory claims about educational assessment’s ‘need to innovate’ ought to be more critically scrutinised to highlight the disjunction between professed intents and actual practice, and to bring into relief a number of powerful social and cultural dynamics that operate at the very heart of education. In order to analyse these contradictions, a good starting point is to turn a critical eye to the mainstream expectations and views that define educational success and quality, which are reflected in how assessment regimes are structured.

Authors have suggested that these views invariably seem to chime with the preferences of the more affluent and privileged groups in society, therefore representing dominant positions that ultimately shape national and school-level policies in relation to assessment. In turn, such policies make it easier for the middle classes to derive advantages from education systems that prioritise high-stakes examinations over more formative and developmental approaches (Brantlinger, 2003; Graue, Kroeger, & Prager, 2001; Lareau, 2003). Even when members of these groups seem to uphold liberal and progressive values, it has been argued that a uniform set of underlying beliefs about the role of education contributes to the persistence of the ‘status quo’ of assessment, with its emphasis on measurement and attainment (see Brantlinger, 2003). Closer scrutiny of these beliefs and expectations is hence necessary to understand the resistance to change of educational assessment.

The defining cultural component of traditional assessment regimes has been described as an ‘ideology of control’, corroborated by a utilitarian view about the role of education – to maximise economic benefits for individuals and for entire countries – and by the positivist assumption that a linear, quantitative relationship can be identified between educational performance and the economic benefits accrued to individuals and to society (Howe, 1994; Noddings, 1992). This type of utilitarian reasoning has been critiqued as a distinctive feature of the American educational culture and the cause of its undue concern for measurement and accountability.

An important caveat needs to be inserted at this point: the literature considered and the ensuing discussion characterise this paper as an analysis of the UK and the US education systems and the related assessment cultures. It would be in fact foolish to assume that the conclusions drawn here could be applied wholesale to all education systems, as local differences are more important than ever even in an age of increasingly globalised and digitally connected education (Selwyn, 2012). This caveat notwithstanding, there are undoubtedly common elements in the nature of assessment regimes in the UK and the USA that could be said to be relevant also in different national contexts.

According to Howe, the bond between utilitarianism and the impulse for control in education was spurred by twentieth-century positivist social science and by the resulting assumption that technocratic solutions could be applied to political and social problems; hence the idea that measurable standards and strict accountability were the *only* way to gauge the overall performance of an education system. This ideology could also be said to underpin the tendency to blame education for faltering economies and for other social failings, as unwarranted parallels are invariably drawn between socioeconomic performance and levels of educational achievement (Howe, 1994).

Utilitarianism and impulse for control also led to an emphasis on ‘core’ academic knowledge, like English and mathematics, and measurable academic goals associated with these subjects became ‘the be-all and the end-all of public education, as well as the means of distributing virtually all educational opportunities’ (Howe, 1994, p. 31). Control mentality and the resulting assessment cultures have had a very conservative impact on school practice, narrowing curricula, disempowering teachers and students, and encouraging an instrumental and strategic use of test scores and examination results in those core subjects which negate their more constructive and formative purposes (Gewirtz, Mahony, Hextall, & Cribb, 2008; Nichols & Berliner, 2007). The ethnographic work carried out by Ellen Brantlinger on middle-class American mothers in 2003 is particularly useful to highlight the contradictions between control mentality, professed values and conservative tendencies in education. Her study illustrated the idiosyncrasies between self-representation, values, and actions that these women had in relation to their children’s education: ‘narratives revealed that mothers perceived themselves (and others of their class) not only as liberals but also as people who valued progressive forms of education’ (Brantlinger, 2003, p. 70). While these claims helped the women maintain a positive self-image, they appeared to be rather fleeting and in effect they were contrasted by much more dominant conservative ideas, which betrayed a preference for traditional academic excellence and ‘rigour’:

Rigour seemed to be a code word for being pushed or being placed in settings with higher levels of academic subject matter content. Mothers trusted that affluent schools would provide the best (most advanced and rigorous) academic environment and were content with the social class-homogenous milieu. (Brantlinger, 2003, p. 74)

These findings are confirmed by evidence suggesting that parental choice in education exacerbates differences between schools on the basis of class, race and ethnicity, without encouraging diversity and experimentation in organisation, curriculum and pedagogy (Blackmore, 1995, quoted in Whitty, 1997). In contrast with the view of innovation as an emerging feature of competitive free markets, these studies have highlighted that education systems should be analysed not as markets, but in their own right, through an appreciation of the political and cultural tensions operating within them. In fact, the introduction of market-like elements (school autonomy, choice, competition for student pools and so forth) in education systems has historically been very problematic, hotly contested, and most crucially did not lead to the expected increases in innovation (e.g. Lubienski, 2003; Whitty, 1997). Emphasis on 'choice' as a means to introduce market elements in education seems inevitably to lead to conformity around dominant images of a 'good school', characterised by academic excellence, uniformity and discipline. Similarly, it has been suggested that the introduction of market elements in education is often associated with a narrowing of the scope of education, and to an almost exclusive emphasis placed on instrumental, academic and cognitive goals (Blackmore, 1995, quoted in Whitty, 1997).

Within this dynamic, it is interesting to see how the rhetoric of innovation is actually used. The mothers in Ellen Brantlinger's study professed progressive values to maintain a positive self-image, but harboured preferences for conservative, 'non-innovative' education. Similarly, claims to innovation made in institutional settings are often accompanied by a contradictory emphasis on traditional academic excellence (Lubienski, 2003). According to Lubienski, who provided an insightful account of the first charter school experiment in the USA during the 1990s, a combination of conditions drove the model of market-based innovation that underpinned those schools – consumer choice encouraging competition and hence innovation – to a rather contradictory outcome: their homogenisation around conservative forms of curricular organisation and assessment. Interestingly, the American Charter Schools resorted to using the rhetoric of innovation as a marketing stratagem, a form of window dressing to 'shape their intake as much as possible through image presentation' (Lubienski, 2003, p. 424), while actual pedagogic practices became uniform, due to the intrinsic 'disciplining' pressure of a performance-based accountability framework that rewarded measurable and standardised performance (test scores). Still according to Lubienski, 'Employing standardised practices and strategies based on "appearances" may be a more effective and less costly option for an organisation than experimenting with new approaches or mediating between conflicting goals' (DiMaggio & Powell, 1983, quoted in Lubienski, 2003, p. 424).

In summary, the introduction of market elements in education, chiefly through the re-definition of citizens as consumers (see also Ozga, 2009), helps us bring into focus mainstream educational values which, despite technological and social changes, are rather homogenous in their utilitarian preference for traditional academic excellence and 'rigour'. Two points can be derived from the review discussed thus far:

- (a) ‘Innovation in education’, as defined at the beginning of this paper, is often used as part of a rhetorical exercise at an individual as well as institutional level, to convey a positive self-, institutional and even societal image not necessarily associated with a genuine wish for reform, or with significant and meaningful changes in actual educational practice.
- (b) Some literature seems to point to a rather wide-ranging suggestion: impetus for assessment reform, and conversely for educational reform, cannot come from consumer choice, or from individual schools and teachers, but only from broader social and democratic debates which call into question the underlying values and ideologies in education and in society at large: utilitarianism, neoliberalism, commodification of culture.

These two points arguably delineate a possible context in which a more critical discussion about the future of education in the twenty-first century, and about its need to ‘innovate’, might take place. Given this backdrop, how do we talk meaningfully about innovation in assessment? The answer, or the method, proposed in this paper is to start from plausible images of the near future, strip them of the more aspirational and utopian elements, and develop an account of how the innovations that they advocate may be used instrumentally; for instance to reproduce the status quo or to strengthen existing inequalities and inadequacies.

### **Future assessment scenarios**

The main aim of the original study which this paper draws on was to identify the innovations in assessment which might have a positive impact on other aspects of teaching and learning. These innovations were then to be described in the context of ‘scenarios’. In this respect, the project was inspired by the literature on ‘educational futures’, which assumes that images of the future can be powerful drivers for action and change (Bussey & Inayatullah, 2008; Facer, 2011; Slaughter, 2004).

More specifically, the methodology was based on a mixed approach combining elements of Delphi technique, Futures workshop and Future Technology Workshop (Jungk & Müllert, 1987; Slaughter, 2004; Vavoula, Sharples, & Rudman, 2002).<sup>1</sup> All three methods are based on systematic techniques and tools to gather ‘expert input’, and that their combined use was an effort towards triangulation of qualitative data (Denzin & Lincoln, 2000). Triangulation is an attempt to secure an in-depth understanding of the phenomena analysed. In this sense, it is not a tool for validation but it represents an alternative to it. Combining multiple methodological practices, empirical materials and perspectives, triangulation configures a strategy that adds rigour and complexity to a qualitative inquiry. The timescale of the project was June–November 2010.

The experts and practitioners were identified through conversations with the project’s sponsor, Becta (a list with several of the experts consulted is provided at the end of this paper) and via an extensive review of current and ongoing work at national and international level in the intersecting fields of education practice, education policy and e-assessment. Evidence used to select experts included recent research reports, conference papers, website profiles, peer-reviewed journal articles and policy briefings.

An initial panel of 12 experts met at the beginning of the project to set the initial agenda. This was followed by a period of consultations and interviews with

additional experts (seven in total), which culminated in a workshop to which 19 representatives from different stakeholder groups were invited. The groups were policy, awarding bodies, industry and teaching.

The interviews and consultations were conducted using semi-structured schedules and facilitated workshop activities. Four thematic areas were explored:

- (a) the emerging issues, drivers and challenges faced by educational assessment against the backdrop of social changes and crises;
- (b) the changing role of evidence about student performance to inform decisions at different levels (classroom level, school level, district/regional level);
- (c) the changing role of the teachers and learners in relation to a range of social, economic and technological influences played out in education;
- (d) the specific opportunities offered by technology to radically innovate assessment.

The first phase of the project resulted in three draft scenarios, which underwent a further refinement process through the final, iterative cycle of data gathering, which targeted a selected group of international experts and ‘innovative’ practitioners (12 in total). This cycle was based on an online open questionnaire followed up by in-depth interviews.

The same thematic areas used in the first phase were used to inform the online questionnaire and the interviews. However, the second phase of the project explored those themes in the context of the draft scenarios, thus eliciting more focused, sometimes critical, views. The final step was a ‘Future Technology Workshop’ that involved seven technology experts from different backgrounds: computer science, immersive technologies and e-assessment.

The outcomes of the project are the following three scenarios:

- multi-data assessment;
- enhanced instructional planning;
- ubiquitous assessment of twenty-first-century skills.

Each scenario is not a prediction and only describes a plausible future for assessment, not by illustrating visionary developments removed from current practice, but by describing conditions in which certain ‘innovations’, which are at present emerging or in an ‘embryonic’ form, have scaled up and become more systemic. In the next section, I shall briefly describe the scenarios, focusing on some important elements shared by all of them. This will be the basis for the critical discussion in the second part of the paper.

### **Multi-data assessment**

This scenario assumes that accountability processes have become more distributed, ‘local’ and open to different types of data. This allows schools to account for the many factors that influence performance at different levels, from the student level to the community level. Schools are required to systematise and present data according to shared, ‘interoperable’ standards based on common protocols and principles, thus allowing educators from different educational settings, e.g. a primary and a secondary school, to analyse student progression from a longitudinal perspective. In this

scenario, technology is not only used to gather relevant information but also to organise and visualise this information in ways that may support ‘Data-Driven Decision Making’, an expression often used in the workshops with assessment experts to describe a more robust form of school improvement that draws on hard evidence and quantitative trends, extrapolated from complex and often automated statistical models and techniques. An early example is ‘Hive’,<sup>2</sup> a web-based tool developed by the education department of the US state of Arkansas, which provides educators with a visualisation software that allows easy manipulation of data and a more structured process to inform school improvement decisions (Gibson & Talburt, 2010).

Part of this scenario is also the use of serious games and simulations capable of collecting complex information about learners in real time, as they perform tasks and solve problems (Shute, Ventura, Bauer, & Zapata-Rivera, 2009). The scenario assumes that these resources are now fully accepted as ways to gather valuable performance data, while the consensus developed around shared interoperability standards means that such data can be easily compared with more traditional measures of attainment. Furthermore, these tools can be accessed by learners on a 24/7 basis, in and out of school, and therefore represent a constant, always-on source of information.

### **Enhanced instructional planning**

In this scenario, teachers act as instructional designers, using data-based, sometimes scripted and semi-scripted techniques to shape learning and to encourage formative assessment in a very structured way. A range of classroom-based ICTs, such as mobile interactive devices and increasingly sophisticated classroom response systems, often running as ‘apps’ on mobile devices personally owned by learners, allow data collection in real time, helping teachers adapt instruction accordingly and almost automatically. These automated processes perform the ‘heavy lifting’ of day-to-day assessment on behalf of teachers, identifying relationships between performance data and presenting them in automatically generated reports to be used in the context of scripted, almost ‘If/then’, instructional techniques. In this scenario teachers are aided by ICTs to implement such scripts. Scripts are being studied and developed in the field of CSCL (computer-supported collaborative learning), where they originated as a metaphor to equate sequences of tasks and interactions in a computer-supported environment to the behaviours prompted and coordinated during a staged performance (Tchounikine, 2008). These scripts can vary from psychology-oriented scripts (micro-scripts) to rather pedagogy-oriented, larger-grained scripts (macro-scripts). A micro-script models a process that needs to be internalised by students. For example, a micro-script will make a student state a hypothesis and will prompt a peer to produce counter-evidence. On the other hand, a macro-script is more like a broader pedagogical method that can be used by a teacher to encourage desired interactions, hence setting the conditions that can support formative assessment activities, such as elaborating on content, explaining ideas and concepts, asking thought-provoking questions, constructing arguments, resolving conceptual discrepancies or cognitive modelling. Teachers draw on these methods to encourage argumentation and rich formative interactions, while feedback is distributed and free-flowing.

### **Ubiquitous assessment of twenty-first-century skills**

In this scenario, assessment tries to reconcile standardised measurement with an understanding of how learners apply important life and career skills in authentic contexts. Schools and other stakeholders involved in the assessment of young people (e.g. employers) routinely perform judgments of so-called ‘twenty-first-century skills’ such as critical thinking, problem solving, independent inquiry, creativity, communication, collaboration and so forth. Due to the complex and very contextual nature of such skills, this scenario assumes that they are assessed within authentic tasks, as students engage in constructivist and collaborative learning, using digital technologies in meaningful and creative ways. This puts a different type of expectation on schools and learners alike. For instance, evaluators are required to draw upon more sophisticated repertoires for their judgments. However, the onus is clearly on learners, who are expected to actively generate and present evidence about themselves, contextualising it in meaningful, real-life situations. Dynamic and open e-portfolios and reputation management tools offered by social networks (e.g. ‘LinkedIn’, and obviously Facebook) have become widespread in this scenario, and routinely used in formal education. These public profiles are filled with rich and complex data about achievements and aspirations in a range of contexts, not only in school.

### **Deconstructing the scenarios**

The scenarios described in the previous sections are not radically different, but describe similar conditions which have implications at the meso and the micro level of schooling: for the whole school (multi-data assessment), for teachers (enhanced instructional planning) and for learners (ubiquitous assessment of twenty-first-century skills). Such conditions are closely interrelated and mutually defining – they can be summarised as follows:

- (a) the introduction of more sophisticated methods of data collection and analysis;
- (b) the assumption that technology can provide the means to collate and benchmark diverse forms of data which would allow assessment to be ‘always on’, that is, carried out pervasively and constantly;
- (c) the re-definition of roles of key agents (whole schools, teachers and learners) with respect to how they collect and present data about performance and achievement in formal and informal contexts.

In this section, I shall discuss the significance of these conditions in the light of the ‘macro’ socio-cultural context described in the introduction. The first part of this discussion will problematise the visionary elements of the scenarios by suggesting a number of more realistic and ‘probable’ developments; the second part will draw on the criticalities noted thus far to articulate the main argument of the paper, that is, the need to de-construct narratives of innovation to unearth underlying normative and conservative agendas.

### ***The introduction of more sophisticated methods of data collection and analysis***

To begin with, it could be argued that a ‘data trend’ is emerging in educational assessment, with a growing interest in the use of ‘learning analytics’ to make sense of large,

often longitudinal, datasets about different aspects of measurable performance and behaviour (e.g. Johnson, Smith, Willis, Levine, & Haywood, 2011).

Unsurprisingly, these techniques are beginning to be commercialised in US compulsory education as they offer the promise of accurate predictions, personalised recommendations and dramatic increases in the efficiency and effectiveness of provision (e.g. SAS, 2011). This trend is spearheaded by recent developments in the digital economy, where consumer data analytics (e.g. Google Analytics) is one of the most profitable sectors. Attempting a forecast based on previous trends in educational technology, where many innovations have been predated by developments in other sectors of the economy (the personal computer in the 1980s, the push for connectivity and the Internet in the 1990s, mobile devices and smartphones in the 2000s), it could be argued that powerful analysis of student data is where significant investment is likely to be found in the near future. Now, the need to make data machine-readable (capable of being processed and modelled by computers) makes it also very likely that any foreseeable development in ‘learning analytics’ will rely on readily quantifiable information: test scores, attendance rates, time on task and completion rates during computer-assisted exercises. Even approaches like e-portfolios and reputation management tools may not represent cost-effective and scalable options in the near future unless they can provide opportunities for data mining, thus placing restrictions and pressures on the types of information that they can contain.

***The assumption that technology can provide the means through which a range of diverse forms of data can be collated and benchmarked, which would allow assessment to be ‘always on’, that is, carried out pervasively and constantly***

Closely related to the previous point is the notion of ubiquity. The speculative thrust of this notion draws on such techno-centric visions as ‘24/7 education’ and, indeed, ‘ubiquitous learning’, which emphasise the emerging opportunities available to learners to collaborate locally, nationally and internationally, overcoming language barriers, time barriers and establishing learning networks anywhere and at any time of day (see Dede, 2011). Such networks are supposedly being created and maintained through a range of connected devices across a range of locations, hence the possibility to gather data, seamlessly and unbeknownst to learners, and to provide immediate and responsive feedback.

In order to tease out the more probable and realistic elements of such a vision, we must venture outside of the educational domain, to consider available research that investigated the actual implications of immersing individuals in eco-systems of connected, data-intensive technologies (see Bohn, Coroama, Langheinrich, Mattern, & Rohs, 2005). For instance, empirical research on ‘U-commerce’ (ubiquitous commerce) has suggested that, faced with uninterrupted feedback loops of data collection and adaptation which would allow products and services to be unpredictably and uncannily ‘personal’, individuals might react angrily and wish for a return to more predictable and less disorienting consumer patterns (Sheng, Fui-Hoon, & Keng, 2008). Similarly, it has been suggested that negative emotional responses may be associated with pervasive and data tracking technologies in so-called ‘augmented supermarkets’ (Rothensee & Spiekermann, 2008).

These studies strongly point to a contradiction in the notion of ubiquitous technology. While it is possible that such technology might provide some opportunities

for ‘mediated immersion in distributed learning communities’ (Dede, 2005, p. 2) – in which educational provision is in tune with the (allegedly) non-linear, associational and communal learning styles of the ‘neo-millennial generation’ (Dede, 2005, p. 2) – it is equally probable that such immersion might lead less fortunate individuals to what sociologists call a ‘crisis of representation’. This condition, broadly characterised by fragmentation and defensive forms of individualism, is said to arise when people experience confusion and uncertainty as to how to represent the world and make sense of it (Harvey, 1990). Similarly, drawing on insights from the psychology of ‘self-regulation’, we could hypothesise that a situation in which learning opportunities – and the associated data-mining assessment apparatus – are totally distributed and pervasive might cause in many learners, most likely those already lagging behind or coming from disadvantaged backgrounds, a state of constant stress in which they would rather focus on maintaining their emotional wellbeing within clearly defined bounds, rather than embarking on a boundless and daunting path of ‘self-development’ (Boekaerts & Niemivirta, 2000).

***The re-definition of roles of key agents (whole schools, teachers and learners) with respect to how they collect and present data about performance and achievement in formal and informal contexts***

Another theme threading across the scenarios is the notion that, as digital media become pervasive and ubiquitous, beliefs associated with privacy and the ownership and personal information need to be revised to meet the demands of the changing socio-economic landscape. Commentators have suggested that digital media have now become fundamental tools in dynamics of social interaction, personal identity and network building among young people. As these tools penetrate their users’ lives, not only do the mechanisms on which they rely tend to become invisible and taken for granted (Luedtke, 2003), they also overtly or covertly require a more fluid and negotiable attitude towards valuable personal information. It is no secret that there are significant interests surrounding the commercial uses of such information and, as a representative of the US Consumer Electronics Association observed:

The mining of personal data is here to stay; there is just too much money at stake to imagine otherwise.<sup>3</sup>

In response to this seemingly unavoidable economic necessity, corporate actors are actively advocating the commoditisation of personal data, whereby consumers are expected to embrace the opportunities that are currently arising by authorising the use of their information and carrying out ‘advantageous’ business deals (Boothe et al., 2010). As more critically minded commentators have observed, there are a number of issues likely to arise from this exchange model, where the promise of ill-defined benefits can obscure the very real threats associated with the loss and the misuse of personal data (Acquisti & Gross, 2006; Debatin, Lovejoy, Horn, & Hughes, 2009).

For instance, many users have been found to be satisfied with the mere *idea* that their privacy is being safeguarded in such environments, without having any notion of, or control over, the actual mechanisms and technologies that operate under the surface (Debatin et al., 2009). Moreover, moving beyond the rhetoric of individual empowerment and self-direction, the reality tells a different story of inadvertent

disclosure of personal information, unsolicited contact, stalking or plain ignorance of the unintended consequences of an intense digital lifestyle (Govani & Pashley, 2005; Jones & Soltren, 2005). Above all, mentions of the proliferation of an unobtrusive infrastructure that supports invisible forms of state-sanctioned or illegal surveillance, are systematically absent in most enthusiastic descriptions and reports. For educational institutions, this may translate in unreflective and instrumentalist forms of behaviour, whereby the promised gains in terms of efficiency and impact on performance conceal the trade-offs of treating student data as if they were removed from the socio-cultural contexts in which they originate.

## Discussion

I have shown in the previous section that the three scenarios described in this paper rely on the co-occurrence of certain conditions which together raise a number of criticalities broadly associated with the proliferation of data, and the resulting emergence of complex, largely opaque technologies for acting on such data. These criticalities can arguably help us move away from the more speculative and idealised discourse of ‘innovation’, and towards a critical understanding of the already unfolding realities of an emerging ‘data paradigm’. Although the ramifications are far reaching and surely they extend beyond the scope of this paper, I would like here to focus on the significance for technology-enhanced assessment in formal settings. More specifically, I aim to consider ‘what might actually happen’ when the rhetoric of innovation stumbles upon the conservative and utilitarian agendas that seem to dominate educational landscapes in the UK and the USA.

As discussed in the introductory section, education systems in these countries seem to reward the more advantaged groups in society, and limited notions of what constitutes academic excellence dominate mainstream expectations and values in relation to assessment. In such a context, powerful techniques to manipulate data are *already* being integrated in the existing frameworks of competitive and hyper-controlling accountability. In fact, the current level of technological development in ‘learning analytics’ is working against the inclusion of more sophisticated forms of evidence in such frameworks. Moreover, the need to rely on machine-readable information legitimates even further the exclusive use of quantifiable and narrow assessment data. As already hinted in this paper, even the current emphasis on networked, live records of performance that rely on social media tools do not seem to offer viable options in the current accountability regimes; *unless* such tools are viewed as opportunities to mine relevant data. These data are then at risk of being used to advance a narrow and potentially inequitable agenda: increasing performance and efficiency, reducing socio-economic variability in the student population and, conversely, creating the sort of homogenous social milieu that attracts the middle classes, and that drives up performance further.

For instance, powerful analysis of student data may enable controversial practices such as using computer-generated predictions to rationalise the ‘weeding out’ of students at risk of underperforming, or to create implicit barriers to access for specific groups. Although such consequences are by no means linked to accountability per se, they have been observed when conditions of competitiveness have pushed schools to pursue a homogeneous social milieu, therefore exacerbating differences on the basis of class, race and so forth (Anushek & Raymond, 2005).

Following on from these considerations, a crucial question arises as to whether an undue emphasis on data manipulation and modelling may contribute to the encroachment of assessment regimes around even more restrictive criteria, whereby alternative and more sophisticated forms of evidence are impossible to consider. Not only because they cannot be readily quantified and included in the machine-readable models, but most importantly because educators may become ill-equipped to recognise those forms of evidence, even in purely conceptual terms, as the computer-generated predictions and diagnoses have the potential to colonise all aspects of the educational discourse – from school improvement, to curriculum, to classroom practices and instruction – due to the inherent ‘seductive power’ of efficiency. This leads to a final set of comments. In a context in which conservative ideas of schooling are dominant, and where ‘innovation’ is often used as part of a rhetorical exercise to merely convey a positive individual or collective picture, it is important to interrogate the purpose of ‘scenarios’ like those described in this paper.

The three scenarios might indeed provide a fascinating narrative of innovation which, however, runs a risk of being used instrumentally to justify the introduction of intensive and pervasive methods of data collection.

### Concluding remarks

This paper contended that narratives of innovation (three ‘scenarios’) in educational assessment may be used rhetorically to disguise the hiatus between aspirations and reality. I have drawn on existing literature and on the available findings to explore the relationship between conservative and progressive tendencies in educational assessment; a relationship which feeds upon contradictions and inequalities in education systems at large. The main contribution of this paper is therefore the highlighting of a problematic conundrum; one that involves innovation and the ensuing rhetoric – e.g. student-centred pedagogies, constructivism, personalisation – and the dominant values in education that *actually* shape accountability frameworks and assessment cultures.

The conclusion is that the deeply political nature of education makes it very likely that the aspirational rhetoric will be ‘hijacked’ to serve ideological or commercial agendas, and to reproduce existing inequalities. This has happened in education in the recent past, for instance through attempts of integrating summative and formative functions of assessment. These attempts have been espoused by some educational systems – notably in the UK and the USA – but, according to critics, they have been undermined by the inability to question the dominance of summative examinations, which meant that ‘integration’ translated in the misguided imposition of a more frequent summative micro-testing regime (Black, Harrison, Hodgen, Marshall, & Serret, 2010). The introduction and the potential growth of data-intensive approaches in assessment may mirror this dynamic, whereby narratives of empowerment, transformation and innovation end up being used instrumentally to pursue managerial agendas which expect schools, teachers and learners to relinquish personal information, in the form of data, pervasively collected through a range of technologies and in a variety of contexts. This risk should not be misinterpreted as a total dismissal of even potentially useful aspects, but rather as a compelling reason to identify more responsible and equitable strategies to deal with the issues which are likely to arise (Perrotta, 2013).

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## Notes

1. Due to word limit constraints, readers are encouraged to consult the original literature for a more detailed description of the methods.
2. [hive.arkansas.gov](http://hive.arkansas.gov).
3. <http://www.bbc.co.uk/news/technology-11571513>.

## Notes on contributor

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## References

- Acquisti, A., & Gross, R. (2006). *Imagined communities: Awareness, information sharing, and privacy on Facebook*. PET 2006. Retrieved from <http://privacy.cs.cmu.edu/dataprivacy/projects/facebook/facebook2.pdf>
- Amrein, A. L., & Berliner, D. C. (2002, March 28). High-stakes testing, uncertainty, and student learning. *Education Policy Analysis Archives*, 10. Retrieved from <http://epaa.asu.edu/epaa/v10n18/>
- Anushek, E., & Raymond, M. (2005). Does school accountability lead to improved student performance? *Journal of Policy Analysis and Management*, 24, 297–327.
- Black, P., Harrison, C., Hodgen, J., Marshall, B., & Serret, N. (2010). Validity in teachers' summative assessments. *Assessment in Education: Principles, Policy & Practice*, 17, 215–232.
- Black, P., & Wiliam, D. (2005). Lessons from around the world: How policies, politics and cultures constrain and afford assessment practices. *Curriculum Journal*, 16, 249–261.
- Blackmore, J. (1995). Breaking out from a masculinist politics of education. In B. Limerick & B. Lingard (Eds.), *Gender and changing education management* (pp. 44–56). Rydalmere, NSW: Hodder Education.
- Boekaerts, M., & Niemivirta, M. (2000). Self-regulated learning: Finding a balance between learning goals and ego-protective goals. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 417–451). San Diego, CA: Academic Press.

- Bohn, J., Coroama, V., Langheinrich, M., Mattern, F., & Rohs, M. (2005). Social, economic, and ethical implications of ambient intelligence and ubiquitous computing. In W. Weber, J. Rabaey, & E. H. L. Aarts (Eds.), *Ambient intelligence* (pp. 5–29). Heidelberg: Springer.
- Boothe, J., Chisholm, M., Cutts, J., DuBravac, S., Joseph, D., Murphy, S., & Slater, C. (2010). Five technology trends to watch. *VISION, CEA – Consumer Electronics Association*. Retrieved from [http://www.ce.org/PDF/2K11\\_5tech\\_web.pdf](http://www.ce.org/PDF/2K11_5tech_web.pdf)
- Boud, D. (1995). Assessment and learning: Contradictory or complementary? In P. Knight (Ed.), *Assessment for learning in higher education* (pp. 35–48). London: Kogan Page.
- Bowman, D. (2004). Thinking through the technology puzzle. *From Now On: The Educational Technology Journal*, 14(1). Retrieved from <http://www.fno.org/oct04/integrating.html>
- Brantlinger, E. (2003). *Dividing classes: How the middle class negotiates and rationalizes school advantage*. London: Routledge.
- Bussey, M., & Inayatullah, S. (2008). Pathways: Alternative educational futures. In M. Bussey, S. Inayatullah, & I. Milojevic (Eds.), *Alternative educational futures, pedagogies for emergent worlds* (pp. 1–9). Rotterdam: Sense Publishers.
- Chaptal, A. (2002). Is the investment really worth it? *Educational Media International*, 39, 87–99.
- Daugherty, R. (1995). *National curriculum assessment: A review of policy 1987–1994*. London: Falmer.
- Debatin, D., Lovejoy, J. P., Horn, A. K., & Hughes, B. (2009). Facebook and online privacy: Attitudes, behaviors, and unintended consequences. *Journal of Computer-Mediated Communication*, 15, 83–108.
- Dede, C. (2005). Planning for neomillennial learning styles: Implications for investments in faculty and technology. In D. Oblinger & J. Oblinger (Eds.), *Educating the Net generation* (pp. 15.1–15.22). Boulder, CO: EDUCAUSE. Retrieved from <http://www.educause.edu/educatingthenetgen>
- Dede, C. (2011). Emerging technologies, ubiquitous learning, and educational transformation. In C. Kloos, D. Gillet, G. R. Crespo, F. Wild, & M. Wolpers (Eds.), *Towards ubiquitous learning – Lecture notes in computer science* (Vol. 6964/2011, pp. 1–8). Berlin: Springer.
- Denzin, N., & Lincoln, Y. (Eds.). (2000). *Handbook of qualitative research*. Thousand Oaks, CA: Sage.
- DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, 48, 147–160.
- Facer, K. (2011). *Learning futures: Education, technology and socio-technical change*. London: Routledge.
- Gewirtz, S., Mahony, P., Hextall, I., & Cribb, A. (2008). *Changing teacher professionalism*. Abingdon: Routledge.
- Gibson, N., & Talburt, J. (2010). Hive: Crowdsourcing education data. *Journal of Computing Sciences in Colleges*, 25, 72–78.
- Govani, T., & Pashley, H. (2005). Student awareness of the privacy implications when using Facebook. *Carnegie Mellon*. Retrieved from <http://lorrie.cranor.org/courses/fa05/tubzhlp.pdf>
- Graue, M. E., Kroeger, J., & Prager, D. (2001). A Bakhtinian analysis of particular home school relations. *American Educational Research Journal*, 38, 467–498.
- Hanushek, E. A., & Woessmann, L. (2008). The role of cognitive skills in economic development. *Journal of Economic Literature*, 46, 607–608.
- Harlen, W., & Deakin Crick, R. (2002). A systematic review of the impact of summative assessment and tests on students' motivation for learning. In *Research evidence in education library*. London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London.
- Harvey, D. (1990). *The condition of postmodernity: An enquiry into the origins of cultural change*. Malden: Blackwell.
- von Hippel, E. (1986). Lead users: A source of novel product concepts. *Management Science*, 32, 791–805.

- Howe, K. R. (1994). Standards, assessment, and equality of educational opportunity. *Educational Researcher*, 23, 27–33.
- Johnson, L., Smith, R., Willis, H., Levine, A., & Haywood, K. (2011). *The 2011 Horizon Report*. Austin, TX: The New Media Consortium.
- Jones, B. D. (2007). The unintended outcomes of high-stakes testing. *Journal of Applied School Psychology*, 23, 65–86.
- Jones, H., & Soltren, J. H. (2005). *Facebook: Threats to privacy*. Retrieved from <http://www-swiss.ai.mit.edu/6805/student-papers/fall05-papers/facebook.pdf>
- Jungk, R., & Müllert, N. (1987). *Future workshops: How to create desirable futures*. London: Institute for Social Inventions.
- Kozma, R. B. (Ed.). (2003). *Technology, innovation and educational change: A global perspective*. Eugene, OR: International Association for Technology in Education.
- Lareau, A. (2003). *Unequal childhoods: Class, race, and family life*. Berkeley, CA: University of California Press.
- Law, N., Pelgrum, W. J., & Plomp, T. (Eds.). (2008). *Pedagogy and ICT use in schools around the world. Findings from the IEA SITES 2006 study*. CERC Studies in Comparative Education. Hong Kong: Comparative Education Research Centre, The University of Hong Kong; and Dordrecht, the Netherlands: Springer.
- Lubienski, C. (2003). Innovation in education markets: Theory and evidence on the impact of competition and choice in Charter Schools. *American Educational Research Journal*, 40, 395–443.
- Luedtke, J. (2003, July 17). Toward pervasive computing – RFID tags: Pervasive computing in your pocket, on your key chain and in your car. *DMReview.com*. Retrieved from <http://www.dmreview.com/>
- McAdie, P., & Dawson, R. (2006). Standardized testing, classroom assessment, teachers, and teacher unions. *Orbit*, 36, 30–33.
- Mioduser, D., Nachmias, R., Tubin, D., & Forkosh-Baruch, A. (2003). Analysis schema for the study of domains and levels of pedagogical innovation in schools using ICT. *Education and Information Technologies*, 8, 23–36.
- Nichols, S. L., & Berliner, D. C. (2007). *Collateral damage: How high-stakes testing corrupts America's schools*. Cambridge, MA: Harvard Education Press.
- Noddings, N. (1992). *The challenge to care in schools*. New York, NY: Teachers College Press.
- Ozga, J. (2009). Governing education through data in England: From regulation to self-evaluation. *Journal of Education Policy*, 24, 149–162.
- Perrotta, C. (2013). Assessment, technology and democratic education in the age of data. *Learning, Media and Technology*, 38, 116–122.
- Perrotta, C., & Wright, M. (2010). *New assessment scenarios. A Futurelab report*. Retrieved from [http://futurelab.org.uk/sites/default/files/New\\_assessment\\_scenarios.pdf](http://futurelab.org.uk/sites/default/files/New_assessment_scenarios.pdf)
- Rogers, E. M. (1962). *Diffusion of innovations*. New York, NY: Free Press.
- Rothensee, M., & Spiekermann, S. (2008). Between extreme rejection and cautious acceptance consumers, reactions to RFID-Based IS in Retail. *Social Science Computer Review*, 26, 75–86.
- SAS. (2011). *Ensuring effective data use in education: How SAS® solutions can help you execute the DQC's recommended 10 state actions to meet NCES directives*. SAS Institute Inc.
- Selwyn, N. (2012). *Education in a digital world: Global perspectives on technology and education*. London: Routledge.
- Sheng, H., Fui-Hoon, F., & Keng, S. (2008). An experimental study on ubiquitous commerce adoption: Impact of personalization and privacy concerns. *Journal of the Association for Information Systems*, 9, 344–376.
- Shute, V., Ventura, M., Bauer, M., & Zapata-Rivera, D. (2009). Melding the power of serious games and embedded assessment to monitor and foster learning – Flow and grow. In U. Ritterfeld, M. J. Cody, & P. Vorderer (Eds.), *Serious games: Mechanisms and effects* (pp. 295–321). New York, NY: Routledge.
- Slaughter, R. (2004). *Futures beyond dystopia: Creating social foresight*. London: Routledge.

- Tchounikine, P. (2008). Operationalising macro-scripts in CSCL. *Journal of Computer-Supported Collaborative Learning*, 3, 193–233.
- Tushman, M. L., & Anderson, P. (1986). Technological discontinuities and organizational environments. *Administrative Science Quarterly*, 31, 439–465.
- Utterback, J. M. (1994). *Mastering the dynamics of innovation*. Boston, MA: Harvard Business School Press.
- Vavoula, G. N., Sharples, M., & Rudman, P. D. (2002). Developing the ‘Future Technology Workshop’ method. In M. M. Bekker, P. Markopoulos, & M. Kersten-Tsikalkina (Eds.), *Proceedings of the International Workshop on Interaction Design and Children (IDC2002)* (pp. 65–72). 28–29 August. Eindhoven, Netherlands: Shaker Publishing.
- Whitty, G. (1997). Creating quasi-markets in education: A review of recent research on parental choice and school autonomy in three countries. *Review of Research in Education*, 22, 3–47.
- Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal*, 40, 807–840.