Nesta

Making the most of data in schools

Matt Stokes

Introduction[1]

Across sectors and across industries, data is fundamentally changing the way organisations and individuals operate, from shopping to relationships, from transport to advertising, from finance to politics. While the public sector has in some cases been slow off the mark, it is now catching up quickly; the UK is now world-leading in areas like opening up government data.

But amid all this, the education sector has made limited progress – a particular shame given the vast amount of data collected in the sector. There are a number of reasons why the sector hasn't made the most out of data, some of which will be discussed here; and although using data in education is nothing new, now is the time to push data to its limits.

Why now, when teachers have been marking books for centuries and school league tables have existed for decades? We have identified three key factors:

- Thanks to better hardware, software and the cloud, data is quicker, easier and cheaper to collect, analyse and understand than ever before.

- The abolition of National Curriculum levels has opened the way for schools to innovate with exciting new ways of tracking pupil progress, and also provides an imperative for teachers to develop their own robust, objective processes for doing so.

- Data presents an opportunity to tackle some of the major issues facing schools today: not just improving attainment, but also improving teacher recruitment and retention, saving money in ever-tighter budgetary conditions, complying with the SEND Code of Practice and increasing use of evidence-based interventions, to name only a few.

With this in mind, we held a roundtable in April 2016 where we brought together leading people in the education sector to discuss issues and opportunities for data in education. We looked at a range of topics, while largely limiting ourselves to looking at data for the purposes of improving attainment (many more roundtables could be held on data's role in behavioural, social and cultural development). Here we bring together some of the most interesting issues and opportunities for data in education.

[1] Many thanks to all those who have contributed to this short paper, particularly Amy Solder, Michael Mann, John Roberts and all those who attended the roundtable.

What's going on at the frontline?

We know that amid teachers' and leaders' packed day-to-day lives, it can be difficult to think about how daunting practices around data can be changed and improved. We also know that talking about teachers as a single group is a simplistic generalisation, and that all teachers will have different attitudes towards, and interactions with, data.

The Bill & Melinda Gates Foundation published the results of a survey in June 2015 which looked at teacher approaches to data. Based on a survey of over 4,000 teachers, it found that teachers tend to fit into one of six categories, ranging from "data maven" – the early adopters who take a data-driven whole-pupil approach – to "traditionalists", who struggle to understand data and the tools available to make the most of it.

Wherever you are on the spectrum (you can take this quick quiz to find out), we're keen to hear from teachers and leaders about the specific opportunities and challenges which they face, and about how those who are less comfortable with data can be supported to make better use of it. Please do get in touch to let us know about your experiences with data.

Flooded with data – what to measure?

The amount of data we can (and do) collect on students is, quite simply, vast: summative, formative and normative data; pupil-level, class-level, school-level and across schools; data assessing learners' cognitive, meta-cognitive and social capacities; data on performance, behaviour, attendance, health and demography; predictive data, often using machine learning; process data, using microanalysis to understand how people learn; real-time and post-fact data; granular and aggregate data… and that is by no means a complete list.

Many teachers already feel overwhelmed by data: 56% of respondents to the Government's Workload Challenge cited "recording, inputting, monitoring and analysing data" as an area where workload could be reduced.

When forming data strategies, the first question leaders and teachers should ask is not "*What data do we need to collect?*", but rather "*What do we want data for – what information will it provide, what questions will it answer and what new questions will it surface?*" The answer to this question will be different for every school, and will depend on factors such as the ethos and priorities of the school, the makeup of its pupils, staff capacity, budgets, size and location.

From here, teachers and leaders can work back to decide which data needs to be collected, by ascertaining which data is **useful and relevant**. Data which does not meet both of these standards is surplus and unnecessary.

This is key, because surplus data can be just as harmful as insufficient data or low-quality data. It wastes teachers' precious time, and teachers who cannot see the use of collecting data will justifiably become frustrated. It can cloud the significant opportunities which data offers and reinforce the belief that data is being collected solely for reporting purposes. Perhaps most importantly, surplus data could have a detrimental effect, if, for example, we use it to band and group pupils unnecessarily, thereby exacerbating cognitive and unconscious biases.

Whatever schools decide to do, they should determine, at a whole-school level, *why data is being collected* before deciding *which data should be collected*. This must be done collaboratively to obtain a shared understanding and buy-in from all levels of staff; it also means that duplication will be minimised.

Data is not a panacea

We believe that better use of data offers a world of opportunities for the education community. But we must make one thing clear at the outset: we do not believe data will be a cure-all for the challenges we face today. Data (in the context of this paper) is not:

- *A replacement for great teaching;*
- *A way of making decisions – it's an aid for humans to make better decisions;*
- *Worth anything if we do not ask the right questions of it; or*
- *An unconditional good – if used badly, it can have detrimental effects on teachers and, more importantly, learners.*

Not another spreadsheet: better data collection

In the Workload Challenge, 63% of respondents said that tasks relating to data were burdensome, 45% said that duplication added to the burden of their workload, and 41% said it was over-bureaucratic. It is an unavoidable fact that data collection is time-consuming – even in schools which are only collecting the data they really need.

It's important to note the difference between data tasks being burdensome (but still often necessary) and *unnecessarily* burdensome (for example because of duplication, unnecessary bureaucracy or collecting data which is not relevant or useful). In both cases, though, there is a clear case for change to reduce the time teachers spend on data-related tasks.

At our roundtable, we discussed a number of principles which leaders and teachers can take into account to help make recording, inputting, monitoring and analysing information an efficient and effective process:

- **Go digital by default:** Where possible, data needs to be collected digitally, not on paper. This makes input quicker, and can even automate many data tasks; it makes analysis easier; it makes data more responsive; it allows sharing between colleagues (as well as with MATs, government, pupils and parents); and it makes data durable, accountable and accessible. And "going digital" doesn't have to mean (indeed, shouldn't mean) more spreadsheets – there are several platforms, such as Arbor Education (a Nesta Impact Investments investee), which can collect, process and present data in far more efficient ways.

- **Get data early:** Data must be collected and inputted as quickly as possible after it has been produced. As well as making data easier to act upon, this reduces the risk to teachers of data loss and of memory bias.

- **Collect once, use many times:** The Government's working group set up to respond to the Workload Challenge made clear that "collect once, use many times" should be a guiding principle in data strategies. (This can be seen as the complement of reducing data duplication.) Schools will often find that different people can use the same data in different ways for different purposes, and using the same source data for different analyses improves reliability and comparability. Aggregation of data allows, for example, teachers to use class data to adjust their teaching; middle leaders to aggregate class data to identify staff and pupils who need support; and senior leaders to aggregate departmental data to identify challenges and opportunities around provision and budgeting.[2]

- **A trade-off is necessary:** There will inevitably be tension between two opposing forces: one to minimise workload, and another to collect the granular and short-term data which has the most potential for impact. There is no silver bullet, and the balance point between the two will vary from school to school. What is important is that that point is clear, and that it is understood among teachers and leaders.

- **Support teacher development:** It's essential that teachers receive professional development to understand best practice for data collection. This could come directly from schools, from professional organisations, or from providers. We heard, for example, from Mathematics Mastery, who hold collaboration days for school teachers delivering the programme both before and after data collection. If collected badly, data can become useless or even detrimental – and teachers who feel ill-equipped to collect data effectively, or who make mistakes and are then admonished, will lose confidence in themselves and in data.

What next? Making use of data

Dealing with data once it has been collected is a daunting prospect at the best of times – let alone when competing with other pressures as teachers and school leaders do every day. While technology has thankfully made the process much easier, there are still crucial issues which need to be addressed.

The key standards of **utility and relevance** are as important for how data is presented as for which data is collected. Data should also be presented **as soon as possible after input**, and in a **coherent, comprehensible and engaging** format. There should be a clear link between what the data shows and what in a school should or should not change as a result.[3]

[2] It is important to note, however, that this can mean formative data is eventually being used where summative data would be traditionally used; or that it can be used for norm-referencing. Aggregation risks undue weight being given to low-stakes assessments, and steps must be taken to ensure this risk is addressed and minimised.

[3] To be clear, data is a support, not a replacement: it can provide the basis for well-informed decisions, but those decisions must ultimately be made by teachers and leaders.

We have heard, however, that data often fails to meet these standards. If it is presented in a starkly different format, or on a different platform, to how it was input, it will be difficult to understand. If it is 100 pages of charts and graphs without explanation, it will not help teachers. If it is not clear what teachers can do as a direct result of data findings, it will not have served its purpose.

Is question-level assessment one of the answers?

At our roundtable, there was widespread agreement that it was not just summative test data collection that was burdensome, but also the ongoing collection of formative assessment data through a range of tools. Worse still, the data points recorded were often not specific enough for teachers to pinpoint gaps and plan action.

Question-level assessment may help us address those problems. By making questions the primary means of formative assessment, teachers are able to pre-define answers in more objective terms. Questions can be answered digitally – usually on a tablet or phone – and fed straight into a management information system (MIS), thereby reducing teacher workload. That data can then be rapidly processed by software and presented as clear, actionable analysis to teachers and leaders.

The data received from question-level formative assessment combined with teachers' thought and judgement allows for rapid feedback to pupils and development of strategies to adjust teaching to most benefit pupils.

Steps must be taken, however, to ensure surplus and low-quality data collection is avoided. Rising Stars, an assessment provider, stressed that teachers must fully understand that data is only as good as the question which was first asked. As a result, schools which choose to implement question-level analysis may need guidance through question design.

What's mine is yours – or is it?

The question of who owns data, and who should be able to access it, is one which all industries and governments are still grappling with. Nowhere is this more so the case than in education. Schools must ensure that they have up-to-date data protection and usage policies which are appropriate for the digital age, not only complying with the law but also addressing some of the ethical grey areas which schools may well take different stances on.

We need only look at inBloom, a US non-profit corporation offering data storage to schools, to understand the risks of perceived or real data storage issues. inBloom, which had received over $100 million in seed funding from the Bill & Melinda Gates Foundation and the Carnegie Corporation of New York, closed in April 2014 following a number of security and privacy issues which led to parent outcry and, subsequently, the decision by many schools to pull out of the platform. If we are to avoid a similar case in the UK, we must proactively ensure that data laws are fit for purpose, but also that ethical issues – which may not be enshrined in law – are open for discussion between industry, parents and schools.

There are several questions which schools must consider with regards to data, including but not limited to:

- *Which teachers should have access to pupils' data?*
- *Who should be able to see normative data about pupil, teacher and school performance?*
- *If decisions are being made because of new data analysis techniques, should pupils and parents have the right to know what these data and decisions are?*
- *Indeed, do parents have a stronger case for owning their children's data than schools, and, conversely, are there instances in which pupil data should not be shared with parents?*
- *What powers should parents and pupils have over their data being used?*

Closely linked to these legal and ethical issues are issues around trust – the perception and fear of data risks, rather than the risks themselves. Even with strong data policies, it is essential that industry, schools and governments work to build trust between themselves and among parents and pupils, so that all stakeholders in data are confident in its security.

Along with all this come far more practical issues. There is anecdotal evidence, for example, of pupils responding well to data analytics which were originally intended for teachers only. We heard from Sparx, a research-based edtech platform, who had seen first-hand pupils embracing data as much as – if not more than – their teachers. Pupils with more awareness of where they are struggling and doing well are more likely to succeed; equally, parents may be able to better support their children with more solid data about where they need help.

But at the same time, such sharing naturally entails risk. Data-driven feedback delivered in the wrong way could discourage pupils and risk promoting a "fixed" mindset. Younger pupils may not understand the complexities of data. Pupils may not be comfortable with teachers sharing their personal data – on attainment or otherwise – with parents or guardians.

Finally, many pupils create massive amounts of data themselves, such as on apps and games, which would undoubtedly be useful and relevant to teachers. But whether they should be able to access it is another question. We heard, for example, about Gojimo, a revision app used by one-third of English school pupils, which experimented with sharing pupil-produced data with teachers. We heard how it quickly became clear that pupils were not comfortable with their private data being shared with their teachers; indeed, one of Gojimo's unique attractions

What's the point of all this data?

We have heard that one of the biggest barriers to embracing data is cultural reluctance within schools. This is not to blame teachers or leaders; neither government nor industry has thus far done enough to show the potential data has, or to help practitioners tackle real and significant problems like unmanageable workload and data protection.

Changing culture needs a two pronged approach: firstly, the opportunities of data should be made clear to school staff at all levels; secondly, the challenges usually associated with data must be addressed.

Both of these will be partly addressed if government, industry and schools develop a strong response to the *why*, *what* and *how* of data collection and use, which was considered above – having a clear purpose of what data is for, determining which data needs to be collected, upskilling staff in data collection, and so on. And when data is presented well, schools rapidly realise how much it can do to help teachers and pupils.

However, this must be accompanied by concerted efforts to encourage a more data-friendly culture within schools. Key to this is collaboration and mutual trust. The whole staff body – from teaching assistants to governors – must be involved in the process of developing and implementing a data strategy, including deciding aims, setting goals and targets, having access to high-quality professional development and receiving upskilling to use technology and data well.

Stories about data – about how it helped a pupil achieve an excellent grade, or how it allowed a teacher to reclaim their evenings – would also help staff embrace data more wholeheartedly. And leaders must make clear that data is being collected to help pupils and teachers, rather than just for accountability, monitoring or fear of Ofsted.

Finally, different people in the system must trust each other's data, understanding that data sharing is essential to reduce duplication and to make data more consistent and reliable. Many secondary schools, for example, assess their incoming Year 7 pupils with a baseline test (such as CAT) by default. We have heard anecdotally that this is because they do not trust primary school SATs, exams those pupils sat only a few months previously. But in several schools, research has shown a close correlation between baseline and SATs results. Put more simply, teachers are spending valuable time, and pupils are undergoing extra stress, on tests which provide minor additional insights. Data-savvy schools should question the utility and relevance of this.

What actually works?

As noted by the Education Endowment Foundation (EEF), which is committed to increasing the evidence base of educational interventions and the use of that evidence, we currently have very limited knowledge about "what works" in terms of data collection and use.

We know that data is important for learning, alongside many other things, but we don't yet know what best practice really looks like beyond anecdote. As noted in a 2016 paper by researchers at the University of Twente, most available studies on data are incomplete for these purposes for four reasons: they tend to be descriptive; they tend to either examine the outcomes or the process of data use, rather than both; they often focus on aspects of organisational context without looking at how those aspects interact; and they often claim causation without sufficient evidence.

The EEF has not yet funded and trials into data usage, but is actively exploring the area; we hope this materialises into funding for organisations using data in innovative ways. For this to happen, we must foster a shared understanding among industry, the research community and within schools about why building an evidence base is so important.

Buy me! Breaking into the market

There are hundreds of innovators with great ideas for how technology can be used to improve education – but relatively few of them manage to grow or scale. We identified three main barriers to market entry and issues with procurement and commissioning processes.

- **Interoperability of platforms**: Currently, data stored on one MIS can rarely be processed by third-party platforms or applications, meaning that valuable data is not being used to its full potential. The Systems Operability Framework is one attempt to tackle this problem, as is the development of Assembly, a platform currently being developed to act as an "intermediary" between an MIS and other data-reliant apps. Schools, industry and government should work together to coalesce around a standard – or develop one if necessary – which makes clear how data should be stored and processed so that new market entrants are able to make use of it.

- **A fragmented market**: Since procurement is organised on a school-by-school basis, it is difficult for suppliers to sell to schools without significant resource devoted to sales teams. It can also make cash flow precarious and prevents organisations from developing economies of scale. And the English education system increasingly has fewer layers of administration, with academies reporting directly to DfE, reducing the possibility for group purchasing.

- **Budgets – and knowing what to do with them:** We all know schools are under extreme budgetary pressure, which means buying new data software can be a difficult decision for leaders to make – especially if it is

untested, or expensive to buy, implement and maintain. This is exacerbated by a lack of intelligent procurement, with decision makers sometimes lacking the skill – and professional development opportunities – to make strategic cost-benefit analyses. We have also heard of confusion about where money for data software should come from – for example, whether it falls under an IT remit or under a departmental/curricular remit. We believe that data must be seen as a core driver of improved attainment in curricula and not an add-on.

Towards data-driven schools

These are by no means the only issues and opportunities for data in education. Here we have taken a conscious decision not to mention, for example, the possible impact of big data, which holds promise for adaptive and personalised learning through technology, or how data could help areas like student wellbeing, back-office school functions or inter-school data sharing, or how the DfE could interact better with data.[4]

Just one recommendation

This paper does not seek to put forward a list of recommendations, although readers seeking recommendations may wish to consult the Bill & Melinda Gates Foundation's excellent report Making Data Work for Teachers and Students, published in June 2015.

However, there is space, and appetite, for different actors to come together and organise a body, or campaign, along the lines of the US's Data Quality Campaign (DQC). This campaign has three main aims: to increase public understanding of the value of data in education; to ensure people have access to information about data in education; and to improve teachers' and leaders' capacity to use data. It does this by bringing together different people to build consensus; by building knowledge and providing recommendations and resources; and by advocating for changes in policy and practice.

We believe a body based on the model of the DQC should be set up in the UK. *A campaign based on the DQC would not have to share the same aims, objectives or strategies. It would have to be suited to the national context: we have, for example, a far smaller investment market in edtech; our policy context is very different from the US's; and the structures of our education system are incomparable. But a concerted effort by all stakeholders to effect change would be more than welcome.*

[4] Having said this, it was heartening to see the Secretary of State, Nicky Morgan, announce earlier this year plans for a "data exchange" which would seek to implement common data standards to make it easier for schools to share data with the DfE. There may also be a role for a data and privacy standards body, but we did not discuss this at our roundtable. Examples of effective government action to support data in schools can be found particularly in the US, for example in California, Georgia and Oklahoma.

It is clear that significant work needs to be done if schools, industry and government are going to make the most of data to improve pupil attainment. The limited take-up of data in the education sector is not the fault of one group. And it will only help improve education if different actors (industry, schools, government) and subsections of those actors (incumbents and start-ups, teachers and leaders, local and central government) work together with a shared vision and understanding. We hope this short paper will provide those interacting with data (and those who want to interact with data) with questions and ideas to harness its power to improve the lives of pupils across the system. We hope it will provoke interesting conversations and look forward to receiving your feedback.

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Issues and opportunities for data in education roundtable

Monday 4 April

Nesta
1 Plough Place
London
EC4A 1DE

Attendees

Dan Bell, Emerge

George Burgess, Gojimo

Nathan Elstub, Nesta Impact Investments

Hilary Fine, Rising Stars

Claire Flynn, Mathematics Mastery

Giles Gibbons, Sparx

Patrick Lee, Department for Education

Michael Mann, Nesta

Isabel Newman, Nesta Impact Investments

Josh Perry, Assembly

James Richardson, Education Endowment Foundation

Amy Solder, Nesta (Chair)

Matt Stokes, Nesta

James Weatherill, Arbor Education

George Windsor, Nesta