Cebr

The case for investment in digital transformation in schools

A Cebr report for Pearson

January 2025

Pearson

Authorship and acknowledgements

This report has been produced by Cebr, an independent economics and business research consultancy established in 1992. The views expressed herein are those of the authors only and are based upon independent research by them.

The report does not necessarily reflect the views of Pearson.

London, January 2025

Contents

Executive summary

Following a commission from Pearson, Cebr is pleased to present the following report on the case for investment in digital transformation in schools. The report assesses the costs and benefits over a ten-year period of achieving a new end state characterised by greater use of educational technology (EdTech). The following represent key points and findings from the report:

- The report presents an economy-wide cost-benefit analysis over a ten-year appraisal period. Overall, the net present value of the intervention could reach as high as £8.7 billion over this period.
- To achieve these benefits, an investment of £1.3 billion is required over ten years, which averages to around £130 million a year. These figures are presented in present value terms.
- This investment has a benefit-cost ratio of 7.9. This value is greater than 1.0, which means that discounted benefits outweigh the discounted costs of achieving the end state.
- We considered an achievable intervention in UK state-funded schools, covering both primary and secondary, capturing increased use of EdTech. This was informed by Pearson's foundational framework on digital transformation in schools. The end state is characterised by greater device provision to students, improved broadband networks, digital skills training for teachers, and an opening up of more digital exam options.
- The largest benefit from the use of EdTech is expected to be time savings for teachers. This benefit is estimated to be worth £894.1 million in the first year of the appraisal period, falling to £657.2 million by the final year.

- EdTech use is expected to improve the skills of students, resulting in higher productivity when entering the labour market and improved earnings. This benefit is estimated to be worth £6.7 million in Year 1. It is expected to grow significantly over the appraisal period to reach £199.1 million by Year 10. This channel brings additional revenues to the Exchequer in the form of higher receipts from income tax and National Insurance.
- Students with greater EdTech exposure are expected to have enhanced productivity. This brings benefits to the wider economy as they enter the labour market. Leveraging the Faethm data set, we estimate that this channel brings benefits of £5.8 million in the first year of the intervention, rising to £181.1 million by the end of the appraisal period. This boost to the economy also generates additional revenues for the Exchequer through a variety of sources.
- There are further benefits observed in the end state, including time savings with students with special educational needs and emissions impacts.
- In assessing costs, a major source is the provision of devices. This would cost an estimated £39.4 million in the first year of the appraisal period, falling to a net present value of £27.5 million by the final year. Larger device stock also incurs additional costs from support and maintenance.
- Broadband installation to improve speeds is estimated to cost £27.2 million in Year 1, falling to a net present value of £20.0 million by the end of the appraisal period.
- The cost of upskilling teachers to become more digitally literate is estimated at £71.3 million in Year 1. This figure falls to a net present value of £52.4 million by the end of the appraisal period. This figure is split between the actual costs of provision and the time cost placed on teachers.
- Two alternative cases are also presented. The first reduces the scope to cover only those impacts commanding a greater degree of certainty. Here, the ten-year benefit-cost ratio falls to 6.5.
- The second alternative case considers the cost-benefit analysis from the perspective of the Exchequer, covering the split between revenues generated and costs incurred. Over the ten-year appraisal period, the benefit-cost ratio is less than 1.0, at 0.8, signifying that the costs exceed the benefits. However, from the seventh year of the appraisal the reverse is true, as the benefits widen over time, meaning that the intervention begins to pay for itself.

Introduction

Existing literature has identified and theorised positive effects from the use of EdTech.[1,2] EdTech generally refers to the combination of educational practices, and information and technology tools, with the intention of facilitating and enhancing learning.[3]

It has the potential to support reductions in teacher workload, yield cost savings, enhance inclusive teaching practices, and improve student outcomes via an increased speed and depth of learning. In addition, EdTech allows for greater personalisation of student learning, with the potential to supplement existing teaching methods with greater student autonomy.[4,5] Lastly, EdTech use also provides scope for increased technological uptake in the labour force as students transition from schools to working life, with positive cycles of digital competency hypothesised as another benefit of increased adoption.[6]

Theorised benefits of technology in schools include the following:

Communication and collaboration

The enablement of improved communication between teachers, students, parents and carers, as well as opportunities for students to learn anywhere and at any time.

Student learning

Teachers are better able to cater to different learning styles.

Awareness

Students and teachers can more effectively stay up to date with the latest developments.

Instant access

Students can easily find materials that help them develop new skills and expand their knowledge beyond that accessible in a textbook.

1 Higgins, S., Xiao, Z., & Katsipataki, M. (2012) The Impact of Digital Technology on Learning

2 Haleem, A., Javaid, M., Qadri, M.A. and Suman, R. (2022). Understanding the role of digital technologies in education: A review

3 Builtin (2022). Education Technology: What Is Edtech? A Guide. Available at: https://builtin.com/edtech. Extracted July 2024.

4 Schmid, R., Pauli, C. and Petko, D. (2023). Examining the use of digital technology in schools

5 Boie, M. A. K., Dalsgaard, C., & Caviglia, F. (2024). Digital instinct

6 Timotheou, S., Miliou, O., Dimitriadis, Y. et al (2023). Impacts of digital technologies on education

Covid-19 brought significant acceleration in EdTech adoption. There has since been increased use of online learning platforms, digital curriculum content tools, and technology to deliver pre-recorded or live remote lessons. Moreover, many schools have invested in devices for students and staff to facilitate learning, particularly in secondary schools and in places where students previously lacked access to technology.

Evidence from several studies suggests that these investments are expected to yield positive impacts. A recent study from the Tony Blair Institute for Global Change suggested that the rollout of an AI-enabled education programme would have a net positive effect, with a benefit-cost ratio that grows over time.[7] The identified benefit channels included improved teaching quality, teacher time savings, and improved attainment.

Chandra and Lloyd (2008) assessed the impact of ownership and use of computers by students on attainment and behaviour differences between socioeconomic groups.[8] They established that computer and internet access at home is important in explaining an achievement gap and plays a role in other behavioural outcomes. A key finding was that, after controlling for Key Stage 3 results, the availability of a computer at home is significantly and positively associated with Key Stage 4 test scores. This association was found to average approximately 14 GCSE points, equivalent to two GCSE grades.

A further study conducted by the Centre for the Economics of Education showed that the achievement of basic digital skills was associated with an increase in hourly earnings of 2.8%.[9] More generally, the findings show that digital skill use at work has a positive and statistically significant impact on labour productivity growth in services and younger firms.

This report aims to contribute to this existing literature, by assessing the costs and benefits associated with digital transformation in education. In particular, we present a ten-year appraisal of achieving wider use of EdTech in UK state-funded schools. We consider a new end state encompassing greater device provision, stronger broadband rollout, digital exams, and more digitally confident teachers. This end state brings benefits in terms of academic attainment and skills, economy-wide productivity, and time and emissions savings, though costs are present in the form of capital spending and investment in training. In general, it is judged that such investment would be sufficient to enable digital transformation and increase use of EdTech in UK schools.

7 Tony Blair Institute for Global Change (2024) – The Economic Case for AI-Enabled Education

8 Chandra, V. and Lloyd, M. (2008). The methodological nettle: ICT and student achievement

9 Dolton and Pelkonen (2007) – The impact of Computer Use, Computer Skills and Computer Use Intensity: Evidence from WERS 2004.

1. Defining the end state

Before discussing the impacts of EdTech adoption, it is first important to define the end state of the cost-benefit analysis. We here consider a number of interventions that would increase the use of EdTech in schools. The following conditions are met in the end state:

Device provision to students

The number of devices per student, covering laptops, desktops, and tablets, amongst schools that currently do not have enough is increased to match the existing mean.

Teachers provided with training

Teachers currently lacking confidence in digital skills are provided with appropriate and ongoing training.

Broadband upgrades

Broadband systems are upgraded for faster coverage for schools currently reporting slow broadband.

Examination formats

Examinations are gradually transitioned to include the choice of a digital format.

The appraisal period covers ten years. This was modelled as starting from 2025, however, the impacts could be considered from any start point.

The satisfaction of these criteria, and the associated investment required, reflects the scenario evaluated within our cost-benefit analysis. The channels considered under this analysis were informed by consideration of the main facilitators of digital transformation in schools. These are defined as follows, based on Pearson's analysis of academic research on the use of digital in schools:

1. **Infrastructure** – Having a sufficient broadband connection and device stock so that all schools are equipped to use technology effectively for teaching and learning.
2. **Leadership and teaching practice** – Providing initial teacher training and ongoing professional development to support with digital leadership and effective pedagogy.
3. **Curriculum and assessment** – Providing teaching and assessment of the digital skills that students need for future life and work.

2. Cost-benefit analysis

This section of the report considers the costs and benefits of achieving the end state. Our approach relied on a range of data sources, including official statistics on the number of schools, students, and teachers, survey results on the current adoption of EdTech, and academic literature pointing to the benefits of technology use in schools. The following subsections present monetary estimates for the costs and benefits associated with EdTech adoption, while outlining the methodology used to understand the various channels.

This section presents an economy-wide cost-benefit analysis, accounting for all of the identified channels. We present further cases later in the report. A secondary case excludes the channels subject to a lesser degree of certainty. A final case focuses only on the costs and benefits accrued by the Exchequer, capturing the required government expenditure and anticipated tax receipts associated with the intervention.

2.1 Costs

In this section, we estimate the costs required to bring about the end state. In general, these cover the equipment and skills necessary for effective EdTech use.

Costs associated with the following four areas are considered:

- Device provision
- Device maintenance
- Broadband improvement
- Teacher training

Overall, the annual costs to achieve the end state reach £147.1 million in Year 1, falling to a net present value of £106.2 million by the end of the appraisal period. The breakdown between cost sources is presented in the table below, with further information presented in the following subsections.

Table 1 – Costs, constant 2025 prices, £ millions, net present value[10]

	Year									
	1	2	3	4	5	6	7	8	9	10
Device provision	£39.4	£38.1	£36.9	£35.6	£33.4	£32.2	£31.1	£30.1	£28.5	£27.5
Device maintenance	£9.2	£8.9	£8.6	£8.3	£7.9	£7.6	£7.3	£7.1	£6.5	£6.2
Broadband	£27.2	£26.3	£25.4	£24.6	£23.7	£22.9	£22.1	£21.4	£20.7	£20.0
Teacher training	£71.3	£69.0	£66.7	£64.4	£62.3	£60.2	£58.1	£56.2	£54.3	£52.4
Total costs	£147.1	£142.4	£137.6	£132.9	£127.3	£122.9	£118.8	£114.7	£109.9	£106.2

Device provision

Effective EdTech use requires hardware. However, there is currently a gap to be closed in the provision of devices to students. This subsection estimates the costs associated with doing so, by first estimating the current spend per device, then applying this cost to the number of additional devices that would be needed to reach the new end state.

Cebr analysis of data from the Department for Education's (DfE) Technology in Schools Survey suggests that the average secondary school possessed just one laptop for every five students.[11] The equivalent figure for tablets was one for every 12 students. The ratio for desktop computers was better at one for every two students. However, the lack of flexibility with desktop computers, particularly in terms of remote study, means that there are fewer benefits relative to other devices and greater limitations in facilitating EdTech use. Amongst primary schools, our analysis suggests that one laptop is possessed for every three students, one tablet for every five, and one desktop for every 15.

Combining these figures with official data[12] on the size of the student population, we estimate the current stock of hardware in UK state-funded secondary schools to consist of 860,000 laptops, 370,000 tablets, and 2.3 million desktops. For primary schools, the equivalent figures are 1.6 million laptops, 940,000 tablets, and 340,000 desktops.

10 2025 prices estimated via Cebr forecasts for consumer price inflation and the GDP deflator.

11 Department for Education (2023) – 2022–23 Technology in Schools Survey

12 Department for Education (2024) – Schools, pupils and their characteristics: Academic year, 2023/24

Cebr analysis of findings from the British Educational Suppliers Association (BESA) suggests that the aggregate EdTech budget for UK secondary schools was £340 million in 2023.[13] Further analysis of findings from this paper suggests that a majority (51%) of this is allocated to devices, equating to a yearly outlay of £173 million. Assuming that devices are replaced every four years, in line with standard depreciation rates, this implies a per device cost of £200. For primary schools, the aggregate EdTech budget is estimated at £372 million, with £173 million spent on devices, implying a per device cost of £240.

There is currently notable inequality in the availability of devices amongst secondary schools. This is highlighted by the fact that the median number of devices per student is much smaller than the mean, signalling a skewed distribution towards schools with larger stock. For instance, the DfE Technology in Schools Survey shows that in secondary schools the median values are one laptop for every eight students, one tablet for every 33, and one desktop for every four.[14] These compare to the mean values of one laptop for every five students, one tablet for every 12, and one desktop for every two. For primary schools, the mean and median values are much closer, suggesting less inequality. The median values are one laptop for every four primary students, one tablet for every seven, and one desktop for every 14. These are similar to the mean values of one laptop for every three, one tablet for every five, and one desktop for every 15.

Meanwhile, a large share of schools report having an insufficient number of devices. According to the BESA State of the Estate report, 34% of secondary schools reported that they do not have enough internet-connected devices and that this limits how technology is used for teaching and learning.[15] Combining this finding with National Statistics on the number of schools suggests that this definition applies to 1,400 individual institutions. Assuming a uniform distribution across schools, the lack of devices is estimated to affect 1.5 million learners. For primary schools, a slightly lower share of schools report not having enough devices, at 31%. Similarly combining this statistic with the number of schools suggests that this definition applies to 6,100 institutions, covering 1.6 million primary students.

Under our end state assessment, we consider the costs associated with providing these schools with additional devices, so that they reach the current mean number of devices. This would necessitate the provision of an additional 0.4 devices per secondary student and 0.1 new devices per primary student. At the per-device costs outlined previously, this would require an initial investment of £157.7 million. Under the assumption of a four-year depreciation period, this equates to an amortised cost of £39.4 million in the first year of the appraisal.

13 BESA (2023) – EdTech Leadership Briefing Paper

14 Department for Education (2023) – 2022–23 Technology in Schools Survey

15 BESA (2024) – State of the Estate

The amortised costs associated with device provision show a slight downward trend over the appraisal period, due to the expectation that the number of students will be declining, meaning fewer devices will be required. By the final year of the appraisal, device provision comes at an estimated cost of £37.5 million.

It is also important to present the figures in discounted terms to capture the fact that costs and benefits in the future are not valued in the same way as those experienced in the present. In doing so, it is estimated that the cost of device provision in the final year of the appraisal period carries a net present value of £27.5 million. This value incorporates an annual discount rate of 3.5%, in line with the social time preference rate used for appraisal and evaluation in HM Treasury's Green Book.[16] This discounting approach is similarly applied to all forward-looking figures discussed in this section, which are all presented in net present value terms.

Device maintenance

The larger stock of devices present under the end state would also necessitate other costs, such as maintenance and additional IT support.

According to BESA, the typical secondary school allocated £9,400 towards technical support in 2023, with the equivalent figure for primary schools standing at £2,540.[17] Combining these figures with data on the number of schools and estimates of their device stock, we obtained figures for the typical technical support cost per device. Multiplying these figures by the number of additional devices required to achieve the end state, we reached estimates for the extra funds that would be required for technical support purposes. In the first year of the appraisal period, these stand at £6.8 million for secondary schools and £2.5 million for primaries.

Over the remainder of the appraisal, these figures are assumed to change in line with the number of devices, which is in turn proportionate to the number of students. By the final year, maintenance costs attract a cost of £8.5 million, equivalent to £6.2 million in discounted terms.

16 HM Treasury (2022) – The Green Book

17 BESA (2023) – EdTech Leadership Briefing Paper

Broadband

Having sufficiently strong broadband is necessary for schools to successfully utilise EdTech. Improving broadband incurs further costs associated with adoption, though these are smaller in magnitude than other sources. This subsection estimates the investment required for schools currently reporting poor broadband to overcome this hurdle. It is important to note that the achievement of better broadband speeds may be out of the control of schools, due to constraints imposed by wider infrastructure. For instance, although the DfE's broadband standards suggest that schools should use full fibre, it is simultaneously acknowledged that many schools still use copper connections.[18] Nevertheless, in the absence of data on the distribution of connection types across schools, we here present a case in which all schools are able to achieve an appropriate connection.

The aforementioned BESA State of the Estate paper showed that 27% of secondary schools reported having slow internet speed.[19] 4% of respondents said that the speed was so slow that it limits how they use the internet for teaching and learning. For primary schools, 36% report having slow internet speed. 8% reported that the speed was so slow that it limits internet usage. The 2023 Pearson School Report further supports this picture, with only half of secondary teachers confirming they have reliable WiFi across their entire school.

These shares were used to infer the number of schools that need to overhaul their broadband network in order to facilitate the digital transformation permissible by EdTech. This definition applies to an estimated 1,100 secondary schools and 7,000 primary schools.

Pricing quotes from Classroom365 place the cost for new broadband in schools between £2,000 and £5,000 per year.[20] Under the assumption that schools currently experiencing poor broadband are paying at the bottom of this range and that this hurdle could be overcome by paying at the top end, it is estimated that the cost of overhaul amounts to £27.2 million in the first year of the analysis, falling to a net present value of £20.0 million by the end of the appraisal period.

18 Department for Education (2024) – Meeting digital and technology standards in schools and colleges

19 BESA (2024) – State of the Estate

20 Classroom365 – School Broadband Services | Internet Security for Schools Available at: https://www.classroom365.co.uk/services/school-broadband/. Extracted July 2024.

Teacher training

A final cost to consider in achieving the end state of better EdTech use concerns human capital, specifically upskilling teachers. This subsection estimates the investment required to provide training to teachers currently lacking the digital skills to utilise EdTech effectively.

According to a Digital Poverty Alliance report, 24% of teachers consider a lack of confidence in their digital skills to be a barrier to using technology in learning.[21] This is used as a proxy for the share of teachers lacking the capability to impact learning via EdTech. Applied to the total population of teachers, this equates to an estimated 127,000 individuals.

To estimate the costs associated with providing training to upskill these teachers, assumptions were made around the number of hours of training required per year and the average hourly cost of such training. Specifically, it was assumed that 20 hours of training would be required, equivalent to the number of hours of EdTech content available in courses provided by the Education and Training Foundation.[22] It was further assumed that the cost of providing such training amounts to £180 per learner. This was based on previous Cebr findings outlining the operational and capital costs incurred by training providers in per learner terms.[23] This calculation results in a provision cost of £23.3 million in the first year of the appraisal period.

The time cost associated with teachers being in training and away from other activities, be those professional or leisure, should also be accounted for. The number of teachers requiring training and the course length was combined with official data on the average hourly wage received by those in the profession.[24] The latter component of this calculation was adjusted downward to account for the fact that teachers systematically work longer than their contracted hours.[25] This calculation resulted in an estimated time cost of £48.0 million in Year 1. This should not be seen as a wage cost over and above teachers' current rates of pay, but rather a valuation of forgone time. As such, when considering the cost-benefit analysis from the perspective of the Exchequer, this channel is not taken into account.

Combining the operational and capital costs with the time cost figures brings the overall cost of provision to £71.3 million in the first year of the appraisal. Over the remainder of the appraisal period, the share of teachers requiring training in each year is held constant, to capture the need to develop new skills and to prevent decay of existing ones. The total cost figure falls to a net present value of £52.4 million by the end of the appraisal period.

21 Digital Poverty Alliance (2024) – Tech4Teachers White Paper

22 The Education Training Foundation. Available at: https://learning.etfoundation.co.uk/. Extracted July 2024.

23 Cebr (2015) – The economic impact of Basic Digital Skills and inclusion in the UK

24 Office for National Statistics (ONS) (2024) – Annual Survey of Hours and Earnings

25 For instance, the minimum core school week is currently set at 32.5 hours in England. Yet, survey data from the Department for Education showed that the average full-time teacher worked 52.4 hours per week in 2023.

2.2 Benefits

This section presents the benefits that could be achieved under the end state of improving device provision, broadband quality, and teacher skills, while transitioning gradually to offering digital formats as an option for exams.

The following four areas are considered:

- Benefits to students' attainment, skills, and earnings
- Benefits to the wider economy from a more digitally skilled workforce
- Benefits to teachers through time savings
- Benefits to the environment

Overall, the benefits achieved under the end state amount to £956.7 million in Year 1, rising to £1.1 billion by the end of the appraisal period in discounted terms. Combining these figures with the costs presented above yields a net benefit of £809.5 million in Year 1, rising to £968.6 million by Year 10. Across the entire length of the appraisal period, the net present value of the intervention amounts to £8.7 billion, with a benefit-cost ratio of 7.9. The breakdown between benefit sources is presented in the table below, with further information on the modelling presented in the following subsections.

Table 2 – Benefits, constant 2025 prices, £ millions, net present value

	Year									
	1	2	3	4	5	6	7	8	9	10
Additional earnings	£6.7	£16.4	£29.4	£46.2	£69.0	£95.8	£122.9	£150.3	£177.5	£199.1
Wider productivity impacts	£5.8	£22.8	£43.2	£51.3	£71.6	£101.4	£129.8	£152.6	£170.9	£181.1
Teacher time savings	£894.1	£865.5	£836.2	£807.9	£780.6	£754.2	£728.7	£704.1	£680.2	£657.2
SEN teacher time savings	£50.1	£48.5	£46.8	£45.2	£43.7	£42.2	£40.8	£39.4	£38.1	£36.8
Emissions savings	£0.0	£0.0	£0.0	£0.1	£0.2	£0.3	£0.4	£0.5	£0.5	£0.5
Total benefits	£956.7	£953.1	£955.7	£950.7	£965.1	£994.0	£1,022.7	£1,046.8	£1,067.2	£1,074.8

Students' attainment, skills, and earnings

The first benefit area concerns the impact of technology use on student attainment. Insofar as students' attainment and skillsets are improved by the use of EdTech, we can subsequently infer wider impacts by leveraging the literature linking such performance to earnings.[26] This establishes the individual productivity impact from greater exposure to EdTech during schooling.

Due to data constraints across different qualification attainment levels, this section focuses on the impact of technology on GCSE performance. However, this can be deemed as a useful proxy for academic attainment and skill development more broadly, with stronger GCSE performance being positively associated with productivity in the labour force. The presence of impacts at GCSE level could thus be used as an instrument for understanding effects across other outcome variables.

Moreover, though this section focuses on exam performance to anchor into our quantitative modelling, it should also be noted that literature has identified positive student experiences from EdTech use beyond this metric. For instance, a meta-analysis by Higgins et al (2012) finds reports identifying gains in students' cognitive skills, reading skills, spelling, writing quality, and word processing, amongst other outcomes.[27] Meanwhile, recent survey results from the DfE show positive sentiment amongst educational leaders around the impact of EdTech on student attainment, with 67% stating that this has contributed to improvements.[28] Further, a recent study from the Tony Blair Institute for Global Change suggested that EdTech use in the form of artificial intelligence could increase students' ability to absorb lesson content, boosting their academic performance.[29] Collectively, these improvements contribute to higher expected productivity amongst those exposed to EdTech when they enter the labour market, enabling higher earnings.

The analysis in this section relies upon findings from the ImpaCT2 study, which show positive impacts between the use of technology and GCSE exam performance.[30] However, it should be noted that our review of wider literature on the impact of technology on educational attainment found mixed evidence, both in terms of the strength and direction of the relationship. For instance, Ahn (2022) finds a negative association between EdTech use and attainment of young students in the US, while the aforementioned DfE survey showed that only a minority of teachers agreed that technology use had improved student performance.[31,32] Nevertheless, we selected ImpaCT2 as the basis for the analysis due to

26 Department for Education (2021) – GCSE attainment and lifetime earnings

27 Higgins, S., Xiao, Z., & Katsipataki, M. (2012) The Impact of Digital Technology on Learning

28 Department for Education (2023) – 2022–23 Technology in Schools Survey

29 Tony Blair Institute for Global Change (2024) – The Economic Case for AI-Enabled Education

30 Harrison, C., Comber, C., Fisher, T., Haw, K., Lewin, C., Lunzer, E., McFarlane, A., Mavers, D., Scrimshaw, P., Somekh, B. and Watling, R. (2002) The Impact of Information and Communication Technologies on Pupil Learning and Attainment

31 Ahn, J. (2022). Exploring the Negative and Gap-Widening Effects of EdTech on Young Children's Learning Achievement: Evidence from a Longitudinal Dataset of Children in American K–3 Classrooms.

32 Department for Education (2023) – 2022–23 Technology in Schools Survey

its geographical relevance, covering the UK specifically, and its status as 'one of the most comprehensive investigations into the impact of ICT on education attainment'.[33] We would caution that this benefit quantification is subject to a lesser degree of confidence than other sources presented in this section.

The ImpaCT2 study showed a range of positive associations between technology use and performance in GCSE examinations across different subjects. The strongest of these associations was found for science, with higher ICT use associated with an improvement of 0.56 of a grade, followed by design and technology, at 0.41 of a grade.[34] Positive associations were also reported across English, mathematics, geography, and modern foreign languages, though with varying degrees of statistical significance.

Other literature has identified the impact of stronger exam performance on lifetime earnings. A report from the Department for Education outlines the expected impact on lifetime earnings of a one grade improvement in GCSE performance across a variety of subjects. For instance, a one grade improvement in mathematics is associated with a discounted lifetime return of £14,500, while the equivalent value for English is £7,300.[35] Considering the attainment improvements identified in ImpaCT2 with the marginal earnings impacts allows us to estimate the average boost to lifetime earnings for a student moving from a low technology-use environment to a high one. This amounts to £10,100 over a working lifetime or an estimated £260 per year.

These improvements are applied to the number of students benefitting from increased device provision under the end state. The labour market pathways of these students were modelled, accounting for the fact that wages and employment rates tend to be weak for early labour market entrants but grow over time. For instance, in the first year of the intervention the impacts are quite small, given that only a minority of GCSE leavers enter employment in the year of completing such studies and those that do so command low wages. However, as these individuals progress in their careers and the number of EdTech-exposed students as a share of the overall labour market grows, the effects become much larger.

Overall, it is estimated that the additional earnings accrued by those becoming more productive as a result of increased EdTech use in school during the appraisal period amount to £6.7 million in Year 1, rising to £199.1 million by Year 10.

Accounting for the ratio between employee compensation and employment-related tax receipts, it is estimated that these additional earnings would bring the Exchequer additional tax revenue of £2.2 million in the first year of the appraisal period, rising to £72.8 million by the final year.

33 Becta (2002) – ImpaCT2: The Impact of Information and Communication Technologies on Pupil Learning and Attainment

34 Students were categorised as being of 'High ICT use' or 'Low ICT use' based on responses to a survey asking about the extent of computer use across three settings: during lesson time, outside lesson time but within school, and outside school.

35 Department for Education (2021) – GCSE attainment and lifetime earnings

Wider productivity benefits

In addition to the personal benefits of higher earnings, the labour market entrants exposed to greater EdTech at school will also have impacts on the wider economy. In particular, their increased exposure to EdTech is assumed to enhance the potential for the rest of the workforce to adopt related technologies, boosting the UK's economic output. This subsection quantifies these wider benefits as measured by gross value added (GVA). The analysis in this section relies on inputs from the student attainment and earnings section. As a result, there is also a degree of uncertainty over these impacts.

This analysis begins with the Faethm data set, which shows the industry-level improvements to productivity that could be attained in the scenario of higher EdTech adoption and is variable depending on the year of the intervention. For instance, in the first year of the intervention, there is a productivity gain of 1.4%, rising to 2.3% and 2.4% in the second and third years, respectively.

The extent to which these productivity boosts are spread across the wider economy depends on a number of factors. For instance, the existing presence of digital skills is important, given that this will affect the share of the population with capacity to upskill themselves. We here leveraged data from Lloyds Bank's Consumer Digital Index showing that 82% of the adult population possess essential digital skills for work, but that there is significant variation amongst regions and workers in different industries.[36] As such, the distribution of activity across the UK economy in both sectoral and geographical terms was also taken into account.

Considering the productivity boost suggested by the Faethm data alongside the labour market entry dynamics of school leavers and Cebr's baseline projections for the UK economy, we calculated the boost to output spilling over from the higher productivity of those with greater EdTech exposure. This amounts to just £5.8 million in the first year of the intervention but rises to £181.1 million by the end of the appraisal period, as school leavers with recent EdTech exposure account for a larger share of the labour market and the productivity of the earlier leavers increases towards its mid-career peak.

This additional activity is expected to yield further tax receipts for the Exchequer from a variety of sources. These include higher employment tax receipts from those not directly exposed to EdTech during schooling, but otherwise experiencing higher productivity, as well as higher consumption tax receipts from those experiencing an earnings boost. The improvement to productivity would also manifest in higher receipts from business taxes. Overall, using the UK's tax-to-GVA ratio, it is estimated that the activity boost would yield additional receipts of £2.0 million in the first year of the appraisal, rising to £68.7 million by the final year.

36 Lloyds Bank (2023) – 2023 Consumer Digital Index

Teacher time savings

Through the use of EdTech, teachers have the potential to save time on tasks, particularly those of an administrative and repetitive nature. This can subsequently be refocused into more productive activity, such as teaching time, providing benefits to output. We here quantify the value of these time savings.

A 2024 report from Pearson looking at the potential impacts of Generative AI predicts that teachers would be able to save a collective 665,000 hours per week on educational planning tasks through the use of this technology,[37] which would allow them to re-allocate their time towards more valuable activities.

Moreover, a 2020 report from McKinsey suggests that teachers could save between 20% and 40% of their hours through use of existing technology.[38] We judge the lower bound of this time saving to be more appropriate for the purposes of this appraisal, given the extent of technological adoption since the study's publication date.

The McKinsey report provides a breakdown of teachers' hours by task, with 10% of weekly hours being spent on administration and 21% on preparation. These two tasks are identified as having the greatest potential to be impacted by technology, particularly through automation and content creation.

In the subsequent analysis, we combine the estimate from Pearson on potential time savings in educational planning with the lower bound of McKinsey's savings estimates to calculate an overall estimate of the potential time savings made possible with EdTech. The figures are then weighted for the share of teachers reporting spending too much time on these activities. As such, the cost-benefit analysis captures a partial elimination of time allocated to administration and preparation.

Overall, we estimate that adoption of technology could save the typical teacher 45 hours per year on administration and 115 hours per year on preparation. Combining this with the wage of the average teacher and the number of teachers expected to benefit yields an aggregate time saving of £894.1 million in the first year of the appraisal period, making it the largest source of benefits considered in this study. The net present value falls to £657.2 million by the final year of the appraisal, reflecting the time discounting.

37 Pearson Skills Outlook (2024) – How Generative AI Can Power People at Work

38 McKinsey and Company (2020) – How artificial intelligence will impact K-12 teachers

EdTech has also been identified as beneficial for students with special educational needs (SEN).[39] We can again consider this benefit through the time saved by teachers in providing support to these students.

National Statistics show that 449,000 secondary school students in England were in receipt of SEN support in the 2022/23 academic year, while 87,000 received support from an education, health, and care (EHC) plan.[40] For primary students, the equivalent figures are 629,000 and 118,000, respectively. After scaling up by the ratio of the UK-England youth population to infer nationwide populations, these figures were used to estimate the number of teachers involved in providing support to students.

We then considered the amount of time teachers spend on behavioural, social, and emotional skill development with students. Applying the 20% time cost saving possible with EdTech suggests that the typical beneficiary teacher could save 32 hours per year, which could then be reallocated to other activities. Scaling this figure by the average wage and the population of teachers expected to benefit yields cost savings of £50.1 million in Year 1, falling to £36.8 million by the end of the appraisal period.

Emissions savings

A final benefit of EdTech considered in this study covers its role in exam provision. EdTech can be used in the process of undertaking exams in schools, notably through providing onscreen formats as an option alongside paper-based exams. Doing so would bring scope for reduced usage of materials and hence reduce the emissions associated with exams. This section considers the emissions and equivalent financial cost savings that could be achieved if all exams were moved to an on-screen format.

The first step of this analysis is to consider the emissions associated with qualifications taken in paper format. Analysis from Ofqual suggested that the carbon footprint of a GCSE qualification amounted to 5.64 kg CO2e per candidate, based on the sitting of two written exam papers.[41]

39 Education and Training Foundation Digital Technologies and SEND. Available at: https://www.et-foundation.co.uk/professional-development/special-educational-needs-disabilities/teaching-and-learning/digital-technologies-and-send/. Extracted July 2024.

40 Department for Education (2024) – Special education needs in England

41 Ofqual (2023) – The carbon footprint of a GCSE

Within this figure, 0.99 kg CO2e was attributed to activities that would be eradicated if exams switched from written to digital formats, specifically printing, pre- and post-exam transport of papers and scripts, scanning and indexing, and post-exam physical storage. This figure represents the estimated emission savings per GCSE entry under the assumption of two papers. Given that the typical GCSE involves two to three papers, this figure was subsequently scaled up. For completeness, we also offset the typical emissions associated with use of a computer screen over a ninety-minute period, the length of a typical GCSE exam. Based on findings from the University of Oxford's IT Services,[42] this equates to emissions of 0.01 kg of CO2e, taking the finalised net saving to 1.22 kg of CO2e.

In 2023, there were 5.5 million GCSE entries.[43] Cebr estimated the number of entries for 2024 at 5.7 million, based on projected growth in the population of GCSE-age students. The number of entries is similarly projected for future years. We combine these figures with Pearson's projections for the staggered rollout of digital assessments for UK qualifications to obtain overall emissions savings estimates and their equivalent monetary values.[44]

Pearson's projections suggest gradual initial take-up of digital assessments, but a sharper increase in the proportion of qualifications assessed digitally by the end of the appraisal period, resulting in nearly 2 million kg of CO2e savings in Year 10.

The Department for Transport's transport analysis guidance (TAG) data book prices one tonne of CO2e emissions at £307 in 2027. Combining this figure with the emissions savings provides a monetary estimate of the reduced CO2e from the staggered switch to digital exams, equating to a discounted £41,000 in Year 3. However, this figure rises to a net present value of £499,000 by the end of the appraisal period.

42 University of Oxford (2022). Environmental impact of IT: desktops, laptops and screens. Available at: https://www.it.ox.ac.uk/article/environment-and-it. Extracted July 2024.

43 Ofqual (2023) – Provisional entries for GCSE, AS and A level: summer 2023 exam series

44 For the purposes of this analysis, Pearson provided high-level assumptions about the potential rate of take-up of onscreen exams. These should not be taken as a statement about the expected roll-out of onscreen exams in the UK.

3. Summary of results

We here present tables outlining the monetary values for each of the costs and benefits over time. Table 3 shows all of the figures described in the above section. Table 4 removes the benefits related to GCSE performance and digital impacts, as these are areas subject to a lesser degree of confidence. Under either of these cases, there is still a net benefit associated with EdTech adoption, driven predominantly by teachers' time savings.

Table 5 presents a cost-benefit analysis from the perspective of the Exchequer. The costs associated with achieving the end state would come directly from the public purse. Here, the cost channels outlined in Section 2.1 are included, with the exception of teachers' time, which is not taken to be an additional cost over and above current resourcing. Simultaneously, the additional tax receipts that would be expected to stem from the benefit channels are considered. This focuses on two of the benefit channels. Firstly, the additional employment tax receipts, covering income tax and National Insurance contributions, accrued by individuals earning more from their greater EdTech exposure are considered. We then consider the tax receipts accrued through the wider spillover effects and boost to GVA. The former channel leverages the ratio between employment tax receipts and total employee compensation, while the latter considers the UK's tax-to-GVA ratio. These ratios were estimated using historical data from the ONS and a time-based projection to capture future periods. In both cases, the ratios are expected to rise over the duration of the appraisal period.

In the early years of the appraisal period, the costs to the Exchequer outweigh the benefits. However, as more EdTech exposed students enter the labour market and the spillover effects widen, the benefits grow to outweigh the costs from the seventh year of the intervention onwards. The gap between the benefits and costs also widens over time.

Table 3 – Cost-benefit analysis, all categories, constant 2025 prices, millions, net present value

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Benefits	Additional earnings	£6.7	£16.4	£29.4	£46.2	£69.0	£95.8	£122.9	£150.3	£177.5	£199.1
	Wider productivity impacts	£5.8	£22.8	£43.2	£51.3	£71.6	£101.4	£129.8	£152.6	£170.9	£181.1
	Teacher time savings	£894.1	£865.5	£836.2	£807.9	£780.6	£754.2	£728.7	£704.1	£680.2	£657.2
	SEN teacher time savings	£50.1	£48.5	£46.8	£45.2	£43.7	£42.2	£40.8	£39.4	£38.1	£36.8
	Emissions savings	£0.0	£0.0	£0.0	£0.1	£0.2	£0.3	£0.4	£0.5	£0.5	£0.5
	Total benefits	£956.7	£953.1	£955.7	£950.7	£965.1	£994.0	£1,022.7	£1,046.8	£1,067.2	£1,074.8
Costs	Device provision	£39.4	£38.1	£36.9	£35.6	£33.4	£32.2	£31.1	£30.1	£28.5	£27.5
	Device maintenance	£9.2	£8.9	£8.6	£8.3	£7.9	£7.6	£7.3	£7.1	£6.5	£6.2
	Broadband	£27.2	£26.3	£25.4	£24.6	£23.7	£22.9	£22.1	£21.4	£20.7	£20.0
	Teacher training	£71.3	£69.0	£66.7	£64.4	£62.3	£60.2	£58.1	£56.2	£54.3	£52.4
	Total costs	£147.1	£142.4	£137.6	£132.9	£127.3	£122.9	£118.8	£114.7	£109.9	£106.2
	Benefits minus costs	£809.5	£810.6	£818.1	£817.8	£837.8	£871.1	£903.9	£932.1	£957.3	£968.6

Net present value, Year 1–10	£8,726.9
Benefit-cost ratio, Year 1–10	7.9

Table 4 – Cost-benefit analysis results, higher confidence categories only, constant 2025 prices, £ millions, net present value

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Benefits	Teacher time savings	£894.1	£865.5	£836.2	£807.9	£780.6	£754.2	£728.7	£704.1	£680.2	£657.2
	SEN teacher time savings	£50.1	£48.5	£46.8	£45.2	£43.7	£42.2	£40.8	£39.4	£38.1	£36.8
	Emissions savings	£0.0	£0.0	£0.0	£0.1	£0.2	£0.3	£0.4	£0.5	£0.5	£0.5
	Total benefits	£944.2	£913.9	£883.1	£853.2	£824.5	£796.8	£769.9	£743.9	£718.8	£694.6
Costs	Device provision	£39.4	£38.1	£36.9	£35.6	£33.4	£32.2	£31.1	£30.1	£28.5	£27.5
	Device maintenance	£9.2	£8.9	£8.6	£8.3	£7.9	£7.6	£7.3	£7.1	£6.5	£6.2
	Broadband	£27.2	£26.3	£25.4	£24.6	£23.7	£22.9	£22.1	£21.4	£20.7	£20.0
	Teacher training	£71.3	£69.0	£66.7	£64.4	£62.3	£60.2	£58.1	£56.2	£54.3	£52.4
	Total costs	£147.1	£142.4	£137.6	£132.9	£127.3	£122.9	£118.8	£114.7	£109.9	£106.2
	Benefits minus costs	£797.0	£771.5	£745.5	£720.3	£697.3	£673.9	£651.2	£629.2	£609.0	£588.4

Net present value, Year 1–10	£6,883.1
Benefit-cost ratio, Year 1–10	6.5

Table 5 – Cost-benefit analysis results, Exchequer-related categories only, constant 2025 prices, £ millions, net present value

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Revenues	Additional earnings	£2.2	£5.5	£10.1	£16.0	£24.1	£33.7	£43.7	£53.9	£64.3	£72.8
	Wider productivity impacts	£2.0	£7.9	£15.2	£18.3	£25.8	£37.0	£47.8	£56.8	£64.2	£68.7
	Additional revenues	£4.3	£13.5	£25.3	£34.3	£49.9	£70.7	£91.5	£110.7	£128.5	£141.5
Costs	Device provision	£39.4	£38.1	£36.9	£35.6	£33.4	£32.2	£31.1	£30.1	£28.5	£27.5
	Device maintenance	£9.2	£8.9	£8.6	£8.3	£7.9	£7.6	£7.3	£7.1	£6.5	£6.2
	Broadband	£27.2	£26.3	£25.4	£24.6	£23.7	£22.9	£22.1	£21.4	£20.7	£20.0
	Teacher training, excluding time costs	£23.3	£22.5	£21.8	£21.0	£20.3	£19.6	£19.0	£18.3	£17.7	£17.1
	Additional costs	£99.1	£95.9	£92.7	£89.5	£85.3	£82.4	£79.6	£76.9	£73.3	£70.8
	Revenues minus costs	-£94.8	-£82.4	-£67.3	-£55.3	-£35.4	-£11.7	£11.9	£33.8	£55.2	£70.6

Net present value, Year 1–10	-£175.5
Revenue-cost ratio, Year 1–10	0.8

Conclusion

This report has contributed to the literature considering digital technology in education by assessing the potential impacts of an achievable intervention in UK state schools. Our core finding is that the benefits of increased digital technology usage are expected to outweigh the implementation costs.

The results show that, even when excluding benefits subject to a lesser degree of confidence, the economy-wide benefit-cost ratio is greater than 1.0, at 6.5. This means that discounted benefits outweigh the discounted costs of investing in increased EdTech in schools. The inclusion of the less certain impacts increases the benefit-cost ratio to 7.9. Both of these results indicate high value for money, with the net present value ranging from a low of £6.9 billion to a high of £8.7 billion.

It is also worth noting that the benefit-cost ratio widens over time, as has also been identified in other studies. This is because the benefits of EdTech grow over time as more former students enter the labour market. Meanwhile, costs exhibit a general downward trend. For instance, the economy-wide benefit-cost ratio over the last three years of the appraisal period is as high as 9.6.

The area of largest impact is on teacher time savings, with EdTech enabling a cut down of repetitive and administrative tasks in favour of more productive activity, such as time in the classroom. The next largest impact comes from earnings and productivity boosts accrued by the economy as EdTech-exposed learners enter the labour market, facilitating the use of technology amongst other workers. Over time, these would become increasingly dominant channels, as a larger share of the workforce is accounted for by those experiencing increased technology use during their schooling.

When looking at the expected costs and benefits from the perspective of the Exchequer, that is, the public costs of the intervention relative to the expected revenues generated, we note that the costs are larger at the beginning of the appraisal period. It is not until the seventh year that this is reversed. This contributes to the revenue-cost ratio over the 10-year appraisal period being less than 1.0, at 0.8. However, as with the economy-wide benefits, the gap between the revenues generated and costs incurred widens over time, meaning that the intervention begins to pay for itself. This delay in anticipated repayment is common amongst investments aimed at improving the supply side of the economy. By the final year of the appraisal period, the revenue-cost ratio stands at 2.0 and would widen further if a longer time horizon were considered.

Overall, the results of this paper indicate that there is a positive and significant return to be obtained from the use of EdTech within schools, both across the economy and for the Exchequer specifically. This suggests that further adoption and investment in such technology is merited and worthwhile.

Cebr

1679696626-Cebr-1 | UKS | Jan 25 | DLC01 | V1.0