Department for Education

The economic benefits of effective Reception classes in England

Research report

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Summary

Most pupils in England start school full-time in the September after their fourth birthday, known as the Reception year.[1] In this report, we find that children in the most effective reception classes can expect to earn more than their peers, in later life.

Research by Durham University had previously shown that children who are taught well in their first year of primary school go on to achieve better GCSE results in Maths and English, making the case for schools putting their best teachers in Reception. In this report, we estimate that the top 2.5% performing reception classes of 27 pupils could add between £50,000 and £200,000 in present value to the UK economy - the equivalent of between £2,000 and £7,500 per pupil.

We scale these estimates to incremental levels of improvement, which may be more feasible for a typical Reception class to make. We relate these estimates to the effect sizes associated with various classroom-level interventions, summarised in the Education Endowment Foundations Teaching and Learning toolkit. For example, investment in teaching phonics could generate upwards of £4.70 in lifetime earnings, for every one pound invested.

There are several estimates of the wage returns associated with educational progress, both before children start school (early years) and across later educational stages. There were no such estimates relating to levels of progress during Reception, representing a “gap” in the literature. Filling this gap was important, because lifetime earnings estimates are used extensively by decision makers: they support the strategic case for investment in the education system, as well as cost benefit analysis in project-level business cases and regulatory impact assessments.

All such estimates are rough, recognising that predicting future earnings is inherently uncertain. In addition to the potential boost in earnings, the social and economic returns from investments in high-quality Reception classes may also be much larger than the study’s estimates, especially for disadvantaged pupils.

[1] Full-time education is not compulsory In England until the 31 December, 31 March or 31 August following the child’s fifth birthday - whichever of these dates comes first.

Introduction

This report was developed by the Department for Education in collaboration with Durham University, combining their respective modelling capabilities. We follow a two-stage approach. First, we estimate the effect of progress in Reception on later GCSE attainment at age 16, using Durham University's research. Second, we estimate the effect of improved GCSE performance on earnings, based on a predictive model developed by the Department for Education.

In publishing this report, we show the advantages of closer collaboration between academic researchers and government analysts, when undertaking policy analysis in education.

The School of Education and Advanced Research Computing at Durham University are developing an agent-based model, which will simulate the effects of various classroom-based interventions on attainment outcomes. As the evidence derived from this agent-based modelling develops, it will be possible to assess the effects of classroom-based interventions in more detail.

The scope of this report is limited to:

- on progress in maths and reading and not, for example, non-cognitive development, which could be equally if not more important;
- labour market outcomes and not, for example, wider impacts on the macroeconomy or wellbeing.

As such, the analysis speaks to wage and productivity gains, which are an important part of any economic case for investment in education. The report could serve as a foundation for further research on the importance of non-cognitive development in Reception, recognising the need to assess wider societal impacts.

Literature

To the best of our knowledge, there are no published studies that estimate the economic returns associated with progress during the Reception year. We limit our review to studies of the wage returns associated with *pre-school* education in the UK, which are the closest in age to our estimates for the Reception Year.

In 1997, the Effective Pre-School, Primary and Secondary Education (EPPSE) study became the UK's first major longitudinal research on the effectiveness of early years education. More than 3,000 children were assessed at the start of pre-school, at approximately three years old. Their development was evaluated up to age 16.[2]

Cattan, Crawford and Dearden (2014) used the EPPSE data to estimate the impact of effective pre-school on labour market outcomes. First, they established that both pre-school attendance and the quality of provision had significant effects on GCSE outcomes at age 16. Second, they use data on labour market outcomes from the UK Labour Force Survey (LFS) and the British Household Panel Survey (BHPS) to predict earnings outcomes, linked to GCSE performance. We follow this two-step method, using GCSEs as the link between early attainment and earnings.

Cattan et al. (2014) found that attending a pre-school was associated with an average 7.9% gain in gross earnings, per individual. Equivalently, this was worth £27,000 in additional earnings over a working life, in present value terms. Attending a "high-quality" pre-school[3] was estimated to generate additional earnings of around £12,500 per individual, when compared to a "low-quality" setting.

In 2013, the Department for Education funded a second major longitudinal study, the Study of Early Education and Development (SEED). This study tracked nearly 6,000 children from across England, from age two. Like EPPSE, the study gathered detailed information on pre-school, school, the home-learning environment, and background characteristics on the children and their families.

Paull and Xu (2017) established a value for money framework linked to the SEED study. The approach linked measures of early development[4] to later outcomes, and then estimated the monetary value of these later outcomes. The largest portion of these monetary benefits was derived from changes in lifetime earnings. Again, this study uses

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[2] The study included follow ups in primary school at ages 6, 7, 10 and 11 (but not in the Reception Year), and in secondary school at ages 14 and 16.

[3] High (low) quality refers to settings in the top (bottom) 20% of the distribution, based on the ECERS-R scale. Other than the differences between high and low quality, the differences in GCSE attainment were either small or statistical insignificant. See Cattan et al. (2014) for details.

[4] Specifically, standardised improvements in the British Ability Scale (BAS) measure of early cognitive skills, and the Strengths and Difficulties Questionnaire (SDQ) measure of non-cognitive skills.

the two-step method – first linking early development to academic performance at age 16, and then predicting earnings outcomes based on age 16 performance.

Paul and Xu (2017) estimated the monetary return associated with improvements in cognitive development (measured as the British Ability Scale naming vocabulary score) and social development (measured as the Strengths and Difficulties Questionnaire total difficulties score) at age three and four. On both measures, a one standard deviation improvement had a discounted value of around £8,000. A one standard deviation improvement in Key Stage 1 attainment, at age seven, was estimated to have a monetary value of around £60,000.[5]

[5] Corresponding to a three-point increase in the KS1 score across all subjects, which ranges from 5 to 20.

Data and methods

Our estimates are derived two studies: Tymms et al. (2018), on the impact of Reception classes on GCSE attainment; and Hodge et al. (2021a) on the earnings returns associated with GCSEs. We summarise their respective data and methods, and how these two sources are brought together in this study.

Estimating the impact of effective Reception classes on GCSE performance

The Centre for Evaluation and Monitoring (CEM) have used the Performance Indicators in Primary Schools (PIPS) to assess the progress and attitude of several million children in primary schools, since 1993.[6] The PIPS assessments are administered by an adult, usually the class teacher or teaching assistant, and have high internal consistency and predictive validity.[7] Assessments are combined to give an overall reading and an overall mathematics score.[8]

Participants in PIPS can be matched to the National Pupil Database (NPD) to create a longitudinal dataset, tracking children from the start of school to the end of compulsory education at age 16. Tymms et al. (2018) use a cohort of school starters in the 2000/01 academic year, who sat their GCSEs in 2011/12.

They used PIPS assessments[9] at the start and end of Reception, to develop a learning progress measure and identify an 'effective' Reception class, defined as one that makes substantively more academic progress than average.

Tymms et al. (2018) use multilevel models, with pupils nested within classes, to identify 'effective' Reception classes. Specifically, they estimate attainment at the end of Reception, controlling for scores at the start of Reception, and a series of individual pupil-level characteristics. They then extract the classroom-level residuals, with 'effective' classes identified as those where residuals are at least two standard deviations above the mean. Out of 2,860 classes studied, 86 (3%) classes were identified as 'effective' for reading and 103 (3.6%) for maths.

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[6] PIPs provided detailed information to schools about the attainment and progress of their students for self-evaluation purposes. The schools volunteered to participate in PIPS and paid an annual registration fee to do so. See Tymms (1999) for more information.

[7] Assessments are computer adaptive. For details, see Tymms (1999), and Tymms, Merrell, Henderson, Albone and Jones (2012).

[8] The reading score is based on name-writing; vocabulary acquisition; concepts about print, letter, and word recognition; reading, and comprehension. The mathematics score is based on ideas about mathematics; counting; number identification; shape identification; informally presented number problems; and formal sums.

[9] See Tymms (1999), and Tymms and Albone (2002).

Further multilevel models were constructed with GCSE English and maths as the outcomes. Membership of an ‘effective’ Reception class was included as an additional variable, to see if it would add to the prediction of attainment. Again, the model controlled for background characteristics, as well as effectiveness of schooling in the intervening period.

Membership of an ‘effective’ Reception class was found to have long lasting effects, with pupils achieving higher attainment at age 16. This amounted to 0.07 and 0.166 standard deviations in maths and English GCSEs, respectively.[10] The GCSE attainment impacts for students who attend an 'effective’ school, throughout Key Stage 1 (KS1) and Key Stage 2 (KS2), are similar in magnitude to being in an ‘effective’ Reception class.[11]

Internationally, there are few studies on the long-term effectiveness associated with progress in the first year at school. An extension of PIPS (iPIPS) looked at results from England, Australia, New Zealand, and Scotland (Tymms et al., 2014; Tymms et al., 2015). A further report looked at the results from South Africa (Tymms et al., 2017). These corroborate that the first year of school is a key juncture for children’s development, one of significant interest to policy makers.

Recent provisions have been made for statutory Reception Baseline Assessments (RBA) and will provide large, representative administrative data.[12] The Department for Education published information on how pupils who participated in the 2015 (optional) Reception baseline, offered by the National Foundation for Educational Research (NFER) performed in their KS1 teacher assessments in the summer of 2018 (Department for Education, 2019).

The relationship between a high RBA mark and KS1 outcomes was statistically significant, using an analysis of variance (ANOVA) test. A significant relationship between reaching high RBA mark and the probability of reaching the expected standard in all three KS1 teacher assessments in the analysis was also observed in logistic regression analysis. For every unit increase in RBA mark, the odds of reaching the expected standard in all three KS1 teacher assessments (reading, writing and mathematics) increased by roughly a tenth.

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[10] On average, these students started below the mean by 0.1 and 0.06 SD for reading and maths, respectively. They then experienced a large boost in their attainment in Reception, which declined by the end of KS1 (age 7) but then remained more or less constant up to age 16.

[11] For the end of KS1, the impacts were 0.16 and 0.21 and for the end of KS2 0.23 and 0.26 SDs for English and maths, respectively. Given that an effective school is defined by progress after KS1, these effects are additional to those associated with an effective Reception class.

[12] The Standards and Testing Agency (2021) sets out the current statutory requirements for a Reception baseline assessment (RBA), with provisions made in The Early Years Foundation Stage and Childcare Fees Regulations of 2021. Provisions have also been made by previous regulations.

For our purposes, PIPS has two clear advantages over the RBA. First, the RBA provides one data point during Reception, whereas PIPS provides two, allowing for measures of progress. Second, PIPS provides data on an earlier cohort of pupils in 2000/01, providing sufficient time to observe outcomes by age 16. At present, we cannot observe longer-term outcomes for pupils taking the RBA.

The impact of GCSE performance on lifetime earnings

Since 2015, it has been possible for the Department for Education to link full educational records contained in the National Pupil Database (NPD) with earnings and benefit data held by Her Majesty's Revenue and Customs, and the Department for Work and Pensions. This linked administrative dataset forms the Longitudinal Educational Outcomes study (LEO). The NPD contains detailed records of all pupils in the state school system in England, including pupils' characteristics, such as Free School Meal (FSM) eligibility, Special Educational Needs and Disability (SEND) status, as well as the schools they attend, and GCSE grades by subject.

LEO contains more detailed information than is available to researchers in representative labour surveys, which were the mainstay of research on the wage returns to educational performance. In these surveys, adults recall information on qualifications, typically obtained several years earlier, which limits the detail of the questions that can be asked about these qualifications. Combined with large samples, LEO allows for more granular analyses, by demographic sub-group and subject.

Hodge et al. (2021a) is the first study, using the LEO data, to estimate returns associated with GCSE attainment.[13] Whilst LEO provides detailed histories of education and earnings, it is limited by the fact linked records only exist for the 1985/86 birth cohort onwards, meaning that Hodge et al. (2021a) only observe individuals' annual earnings up to age 29. Additional information from the UK Labour Force Survey is used to predict earnings trajectories, over the rest of an individuals' working lives.[14] Each trajectory is simulated multiple times before the results are 'collapsed' into a discounted present value of lifetime earnings. These present values are the dependent variable in a set of regression equations. To isolate the marginal effect of a ceteris paribus improvement in

[13] Research using LEO initially focused on higher-level qualifications. Espinoza and Speckesser (2019) estimate the earnings returns associated with National Vocational Qualifications (NVQ) at levels 4, 5 and 6. Britton et al. (2020) explored the returns to university degrees, exposing significant variation by subject and institution.

[14] Whilst there is a degree of randomness in individual earning paths, there is also a degree of dependence on earnings realisations in previous periods, modelled using copula functions. In addition, the LFS is used to model employment status transition probabilities and their impact on lifecycle earnings growth. This model allows us to then simulate complete age-earning profiles for each individual in the LEO data, resolving the missing data problem.

each subject, a series of univariate regressions are estimated, one for each subject, controlling for attainment in other subjects.

Hodge et al. (2021a) estimate the total effect of GCSEs on earnings, including direct effects of improved performance in school, and induced changes resulting from subsequent educational and occupational choices. They provide estimates of the lifetime earnings returns to standardised improvements in GCSE scores, both in terms of overall points scores and in each subject. Importantly these are estimates at the 'intensive margin' (how well pupils do in each subject), contrasting with previous returns associated with the 'extensive margins' (e.g., the total number of GCSE passes achieved) reported elsewhere.[15]

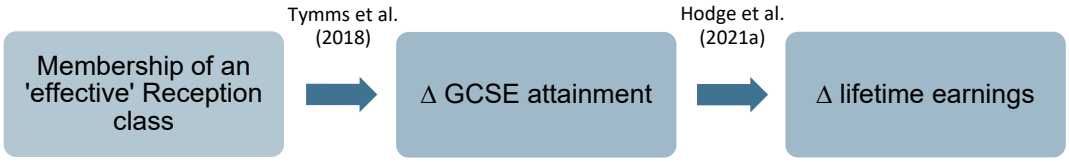
Hodge et al. (2021a) estimate that a one-standard deviation (equivalent to 11.2 grades) improvement in overall GCSE performance was associated with an increase in discounted lifetime earnings of £96,000. These returns are sizable, representing nearly 20% of the average discounted earnings, up to retirement.

For the purposes of this report, the key results pertain to maths and English. A one standard deviation change in maths attainment is associated with £28,700 in discounted earnings, in a range from £21,800 to £35,700; for English, the return is £14,200, ranging from £6,600 to £21,800.

Two-step method

It is reasonably straightforward to combine estimates from Tymms et al. (2018) and Hodge et al. (2021a) to develop the simple pathway shown in Figure 1.

Figure 1: Causal pathway



The respective PIPS and LEO pupil cohorts took their GCSEs between 8 and 10 years apart, and 10 to 20 years from the present day.[16] The GCSE grade distribution has changed somewhat over these time periods: 2017 also saw the phased introduction of a "number" grading system, with a non-identifiable translation between it and the old "letter"

[15] See for example McIntosh (2006); Greenwood, Jenkins and Vignoles (2007); Hayward, Hunt and Lord (2014).
[16] The PIPs data covers one cohort who were in Reception Year during 2000/01 and who sat their GCSE in 2012; whereas the LEO data covers three cohorts who took their GCSEs between 2002 and 2004.

grades. Hodge et al. (2021a) abstract from this problem because, alongside grades, they report estimated earnings returns for standardised effect sizes. We assume that the standardised returns to English and maths GCSEs hold constant over time. Additionally, we apply average earning growth[17] from the early 2000's to the present day.

Combining multiple sources, over different time periods, is commonplace in economic appraisal. The time lags required to observe 'lifetime' outcomes associated with a given policy intervention are impracticably long, and so we rely on predictive modelling. Note that the effect of contemporary policy on future earnings is inherently uncertain, as the labour market in the coming decades could look very different, when compared to our modelled estimates drawn from historic earnings data.

It is impossible to overcome issues with time inconsistency, but they ought to be kept in mind when applying estimates from this report in policy appraisal.

It is also important to caution against an overly strong causal interpretation of our estimates. Despite extensive controls for observed background characteristics, one cannot infer causality from a selection-on-observables approach.

With these caveats, we consider our results to represent a first approximation of the wage returns associated with progress during the Reception Year.

[17] Using the ONS' "EARN01: Average weekly earnings" dataset.

Results

Tymms et al. (2018) estimate effect size improvements in GCSE maths and English language to be 0.070 (0.011) and 0.166 (0.011)[18], respectively. Based on the distribution of GCSE attainment in 2019, these effects would see the average pupil in an 'effective' Reception class gain the equivalent of around 0.15 grades in maths and 0.31 grades in English language.[19]

Table 1: Effect size improvement in GCSE maths and English language, associated with belonging to an 'effective' Reception class - Tymms et al. (2018)

	Low	**Central**	High
GCSE Maths	0.048	**0.070**	0.092
GCSE English language	0.144	**0.166**	0.188

Using Hodge et al. (2021a) we derive estimates of the 2022/23 present value of lifetime earnings associated with a one standard deviation improvement in GCSE maths and English language, respectively.[20]

Table 2: Lifetime earnings returns associated with a 1 standard deviation improvement in GCSE maths and English language, 2019/20 prices – based on Hodge et al. (2021a)

	Low	**Central**	High
GCSE Maths	£21,800	**£28,700**	£35,700
GCSE English language	£6,600	**£14,200**	£21,800

The effects of GCSE maths and English are independent and so it is possible to add the two separate effects together, without significant risk of "double counting". These estimates are more likely to undervalue the benefits of being a member of an 'effective' Reception class, noting that improved literacy and numeracy skills are also likely to have a positive effect on performance in other GCSE subjects.

Table 3 shows the lifetime earnings gains associated with belonging to an 'effective' Reception class, when compared to similar pupils in an average class. Combining the figures in tables 1 and 2, we estimate that each pupil gains £4,400 (ranging from £2,100 to £7,400). The average class size for infant pupils (Reception, Year 1, and Year 2) was

[18] The figures in brackets denote the standard errors of the effect sizes.

[19] Based on the 2019 distribution of attainment, by subject. Derived using the National Pupil Database.

[20] Department for Education estimates based on its GCSE Lifetime Productivity Ready Reckoner model. This model is underpinned by the lifetime earnings estimates in Hodge et al. (2021a) associated with standardised changes in attainment for pupils taking their GCSEs in 2002-04. The internal model makes further adjustments to these effect size changes, based on the grade-point distribution of attainment in 2019.

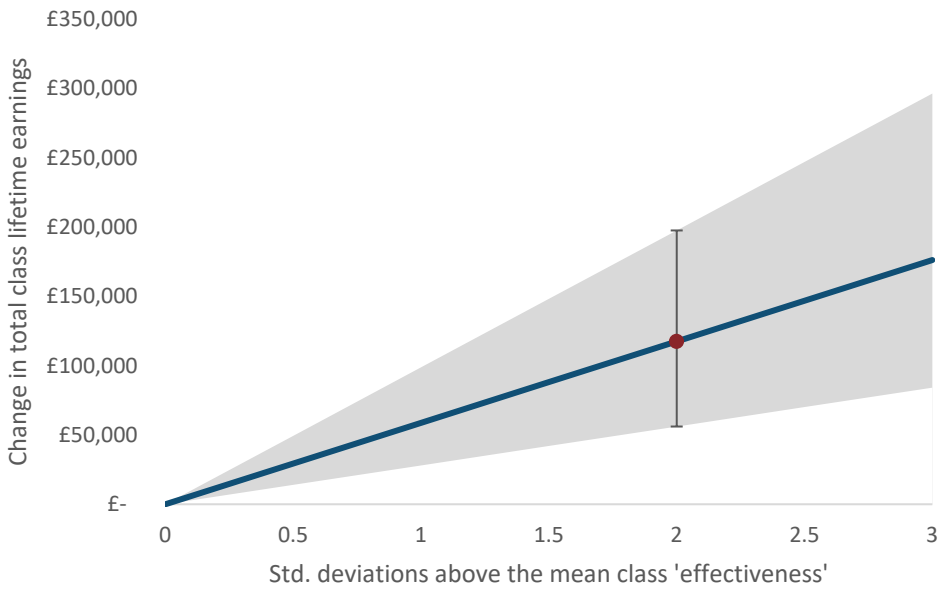
26.7 in the academic year 2021/22.[21] On this basis, the earnings return for the whole class would be £117,500, ranging from £56,100 to £197,600.

Table 3: Estimated lifetime earnings benefits associated with 'effective' Reception classes

	Low	**Central**	High
GCSE Maths	*£1,100*	***£2,000***	*£3,300*
GCSE English language	*£1,000*	***£2,400***	*£4,100*
Total per pupil	£2,100	**£4,400**	£7,400
Total per Reception class (26.7 pupils)	£56,100	**£117,500**	£197,600

Only a small percentage of the Reception classes in Tymms et al. (2018) are classed as 'effective'. This is not surprising, if the distribution of Reception class 'effectiveness' follows a standard normal distribution we would expect only 2.5% of classes to be 2 standard deviations above mean 'effectiveness'. We might reasonably assume that the effects are linear, as illustrated in Figure 2.

Figure 2: Class level lifetime earnings increase associated with improvements in Reception class 'effectiveness', assuming linear effects



This would imply the impact of increasing class 'effectiveness' by 1 standard deviation is associated with an increase of £58,750 (£28,050 - £98,800) in future lifetime earnings per

[21] There is a statutory limit of 30 pupils in an infant class (The School Admissions (Infant Class Sizes) (England) Regulations 2012). Estimates of the average class size are based on figures reported in 'Schools, pupils and their characteristics: 2021/22'. These national statistics are updated regularly: the estimates used in this report were published on 9 June 2022. Published estimates for infant class sizes are not disaggregated further to provide an estimate specially for Reception. For details see: https://explore-education-statistics.service.gov.uk/find-statistics/school-pupils-and-their-characteristics

class. Similarly, if effects are mirrored, for example a class moving from 1 standard deviation below the average to the average we would see the same return.

In a similar way, we can estimate the potential returns associated with classroom level interventions, with varying levels of effectiveness. The Education Endowment Foundation's (EEF's) Teaching and Learning Toolkit[22] evaluates the effectiveness of a range of school-based interventions in a consistent way. This can help to connect our estimates to the range of interventions that are available to schools, many of which could be deployed in Reception classes.

The EEF Toolkit translates effect size improvements into the number of additional months of progress made, on average, by children who received a given intervention, compared to similar children who did not. Effect sizes describe these differences in a standardised way and are typically preferred in the literature. The EEF recognise that these effect sizes can be difficult to understand in lay terms and so they take two further steps to make this evidence more accessible. First, they translate effect sizes into a months of progress measure. Second, they group interventions into descriptive categories, from "very low or no impact" through to "very high impact".[23]

Several interventions included in the EEF Toolkit are associated with "high" impact, including collaborative learning approaches, one-to-one tuition, and phonics. This means that pupils in the classes where these interventions were provided made, on average, five months' more progress (equivalent to between 0.36-0.44 standard deviations), than similar pupils in other classes.

Taking phonics as an example, the EEF note that the average cost of intervention is "very low", up to £2,000 per year per class of 25 pupils, or less than £80 per pupil per year.[24] The security of the evidence around phonics is also rated as "very high" with 121 studies identified that meet the EEF's inclusion criteria, based on their standards of evidence.[25] Even taking the lower end of our range of estimates, one pound invested in phonics during Reception could generate an average return of around £4.73 (Table 4).[26]

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[22] Available at: https://educationendowmentfoundation.org.uk/education-evidence/teaching-learning-toolkit

[23] See appendix for a full conversion table

[24] The phonics strand of the EEF toolkit is available at: https://educationendowmentfoundation.org.uk/education-evidence/teaching-learning-toolkit/phonics

[25] A meta-analysis of the 121 studies is available at: https://educationendowmentfoundation.org.uk/education-evidence/teaching-learning-toolkit/phonics/technical-appendix

[26] The EEF's cost estimate of £2,000 for 25 children is scaled to 26.7 children (=£2,136), for comparability with our lifetime earnings benefits in Table 4. The implied benefit cost ratio is 5:1 (= £10,098 / £2,136).

Table 4: Cost benefit analysis based on classroom-level investment in phonics interventions, using evidence from the EEF Teaching and Learning Toolkit.

Cost	
Average cost of phonics interventions	
…25 children	£2,000
…26.7 children	£2,136
Impact	
Months' progress	+5
Return per Reception class (Low)	£10,098
Cost Benefit Analysis	
Net Present Value	£7,962
Benefit Cost Ratio	4.73:1

The EEF encourages practitioners to look “behind the averages” in their toolkit and the same advice would apply to the use of Table 4. For instance, the EEF summarises the evidence on phonics across ages 4 to 7. Given that we estimate returns specifically for Reception, one would ideally consider differences in the effectiveness of phonic interventions, by year group.

One might then need to appraise whether: a) efficacy is maintained at scale; b) account for any negative effects from substitution or displacement of other classroom activities; and c) make appropriate adjustments for optimism bias. As such, we would caution against direct use of the indicative cost benefit analysis in Table 4, as all quantifiable appraisals must consider context-specific evidence.

Discussion

Wages are commonly used to value the economic benefits of investments in education, but this provides only one lens through which to view the economic and social value of investments in early education. We explore other perspectives briefly, to place the results above in context.

Our analysis abstracts from the relative benefits of each stage of education. Tymms et al. (2018) find a weak correlation between belonging to an 'effective' Reception class, and belonging to an "effective school", where the latter is based on levels of progress made between KS1 and KS2. By implication, the estimated economic returns to effective Reception classes, in this report, are predicated on a roughly average experience during the rest of primary – investing in above-average development after the first year would only accentuate these benefits. However, human capital theory underscores that *skills beget skills* (see Cunha and Heckman (2007)), and so it remains important for policy makers to look in detail at how the benefits of the Reception year are conditioned on both earlier and later development.

By aggregating predicted changes in earnings, the economic benefits are best described as a private (rather than social) return on investment, accruing to the pupils that directly benefit from belonging to effective Reception classes. In this context, it is important to note wider positive effects that might determine the net social value of investments in Reception, such as:

1. Non-cognitive skills: our estimates are based on measurable progress in maths and reading. The Reception Year will also have a bearing on behavioural, social, and emotional development. See Sammons et al. (2014) for a more detailed exploration.

2. Attainment spill overs: benefits are associated with observable impacts on English and maths GCSEs. We might anticipate that the effects of improved literacy and numeracy skills on outcomes later in life are also mediated through other subjects.

3. Peer effects: earnings benefits accrue to the pupils within an effective class, and so this ignores any spill over effects on peers and siblings.

4. Productivity growth: Hanushek and Woessmann (2015) advanced the argument that long-run growth is overwhelmingly caused by "knowledge capital". The returns to literacy and numeracy skills are found to be multiple times higher than individual wage returns. Macroeconomic estimates capture endogenous growth and wider benefits, although they are generally considered to be an upper bound, and less robust than a microeconomic approach (Crawford and Cattan, 2013; Hodge et al., 2021b).

The above factors suggest we might underestimate the benefits associated with progress in Reception: on the other hand, signalling and screening effects could imply that we have overestimated the value of improving Reception class effectiveness. The associations between earnings and GCSE attainment could simply signal pupils' developed abilities, rather than the gains in human capital made during school. The value of school attainment, as a rough measure of individual skill, has been verified by a wide variety of studies of labour market outcomes. Wyness, Macmillan and Anders (2021) concluded that:

> "The most convincing quantitative studies from the literature suggests that signalling plays a relatively limited role. This, coupled with causal evidence of the wider non-pecuniary benefits of education, implies that failing to invest in education, particularly at critical ages and stages, would be a very risky strategy for governments to adopt."

We also need to consider variation in our estimates by pupil subgroup. There are at least three reasons why the economic benefits of effective Reception classes might vary by socio-economic status and other pupil characteristics:

1. the effect of Reception classes on later GCSE maths and English varies;
2. marginal changes in these GCSE results have a differential effect on earnings;
3. the welfare value of additional income varies.

The first effect may be the weakest: Tymms et al. (2018) concluded that the effectiveness of schooling during the first year at school was not associated with equity in GCSE outcomes, based on measures of income deprivation.

The second effect is significant: for example, Hodge et al. (2021a) report a 9% lower earnings return associated with marginal improvements in GCSE grades, for pupils those who are eligible for FSM (Hodge et al., 2021a).

The third effect may be the strongest: income generally improves subjective wellbeing at a decreasing rate (Layard, Nickell and Mayraz, 2008). That is, the value of an extra pound in earnings is worth more to people on lower incomes, than those on higher incomes (H.M. Treasury, 2022). The economic benefits in our analysis are 'unweighted', meaning that we implicitly assume that a pound in additional earnings has the same value for all pupils, no matter their socio-economic background, or where they live.

Welfare weighting would have a significant effect on our estimates above, in which we adjust the value of additional income to account for its effect on personal wellbeing. The DfE's *Schools Policy Appraisal Handbook* (Hodge et al., 2021b) gives an illustrative example of welfare weighting, applied to pupil's lifetime earnings.

Tentatively, DfE propose a mean average welfare weight for Free School Meal (FSM) eligible pupils of between 1.53 and 1.71. This would more than offset the 9% lower marginal earnings returns and so, overall, we might conclude that lifetime earnings gains from effective Reception classes are larger in welfare terms, for disadvantaged pupils.

The H.M. Treasury (2021) *Wellbeing Guidance for Appraisal* highlights several other factors that could be considered, in a more detailed analysis of these welfare effects. For example, wellbeing research suggests that individuals' relative position can matter more than their absolute position.[27] An increase in someone else's income can reduce the sense of wellbeing of a person whose income does not rise (Clark et al., 2018). As such, we would ideally consider how income comparisons affect life satisfaction.

Further, by focussing on changes in income, we are liable to miss some of the main effects associated with raising levels of early literacy and numeracy. These skills could plausibly reduce the risk of:

- being on very low income, sufficient to meet basic needs;
- spells of unemployment; and
- poor job quality.

Even controlling for income, these effects are known to be important influences on life satisfaction as people generally do not adapt to such negative outcomes.[28]

[27] See Di Tella, Haisken-De New and MacCulloch (2010), Clark and Oswald (1996) and Easterlin (1974)

[28] See for example Clark et al. (2018) and De Neve and Ward (2017).

Appendix

Months of progress

Table 5: Education Endowment Foundation's conversions from effect sizes to months of progress

Months' progress	Effect size		Description
	From…	to…	
0	-0.05	0.05	Very low or no impact
+1	0.06	0.09	Low impact
+2	0.10	0.18	Low impact
+3	0.19	0.26	Moderate impact
+4	0.27	0.35	Moderate impact
+5	0.36	0.44	High impact
+6	0.45	0.52	Very high impact
+7	0.53	0.61	Very high impact
+8	0.62	0.69	Very high impact
+9	0.70	0.78	Very high impact
+10	0.79	0.87	Very high impact
+11	0.88	0.95	Very high impact
+12	0.96	1.00	Very high impact

Source: Education Endowment Foundation (2021), p.6

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