Glasses in Classes: a two-armed cluster randomised trial

Evaluation report

December 2022

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About the evaluator

The Glasses in Classes intervention was independently evaluated by a team from the University of Nottingham, initially under the leadership of Professor Roisin Corcoran (up until February 2021) and latterly by Professor Andrew Noyes (from March 2021). The full team also comprised Dr Michael Adkins, Dr Stanimira Taneva, Alex Phillips, and James Fox.

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Acknowledgements

The research team and authors of this report are indebted to the many senior leaders, teachers, and their pupils who took part in the trial and made this evaluation of Glasses in Classes possible; both those who took part in the intervention programme and those who went about their business as usual. The time and effort they gave to ensure that we had adequate data to work with and their enthusiasm for the research even during the COVID-19 pandemic was essential, and we cannot thank them enough.

We would like to thank Professor Roisin Corcoran for her invaluable work in establishing the evaluation team, her expertise in designing the evaluation activities, and authoring the pre-pandemic versions of the protocol and Statistical Analysis Plan.

We would also like to thank the delivery team led by Dr Alison Bruce and Professor Mark Mon-Williams for their support and engagement throughout the evaluation, in particular through the challenging period during the pandemic. The team over the period of the trial at various times included: Katherine Bavage; Dr Emily Williams; Dr Shegufta Farooq; Dr Chris Davey; Jenny Cheung-Crossley; Suniya Raouf; Hafsah Hussain; Fhateha Ali; Mahria Banaris; Maarya Daji; Ayishah Khan; Iqra Khan; Maryama Warsame; Saira Waseem; the orthoptic vision screening team led by Louise Outhwaite; and the optometry and ophthalmic teams based in Bradford Teaching Hospitals NHS Foundation Trust. We would also like to thank the community optometrists based across Bradford Metropolitan District for their engagement and support throughout the trial.

We greatly appreciate the support of the team at the Education Endowment Foundation for their unstinting patience throughout the extended timeline of the project and, more recently, their attention to detail during the final stages of compiling the evaluation report. This has included at various times: Celeste Cheung; Sarah Tillotson; Peter Henderson; and Camilla Nevill.

Finally, as a research team we work closely with our Research Operations Team in the School of Education and without their careful attention to the detail of collecting and processing the large volume of data from across all schools we could not have managed to complete this work. We would particularly like to acknowledge the work of Alex Phillips and James Fox.

Executive summary

The project

The aim of the Glasses in Classes (GiC) intervention was to improve the literacy and numeracy skills, as well as the visual acuity, of children in Reception year (age 4–5). It is recommended that all children in England receive an eyesight test (vision screening) in their Reception year, which is usually provided by health services and results shared with families, but not schools. Roughly 10–15% of children fail their eyesight test, and of these around a third are not taken to the opticians to obtain glasses.

The intervention, developed by the Centre for Applied Education Research (CAER), aims to increase the number of children who obtain and consistently wear glasses following the eyesight test by involving both schools and families. The eye test results are shared with schools, staff are trained to support pupils and their families to get glasses and encourage pupils to wear them, and pupils receive a second pair of glasses to keep at school. Each participating school has a vision coordinator (VC), supporting the relationship between school, families, opticians, and health services. The intervention targets children who were initially assessed at vision screening and referred for an eye test (refraction).

The intervention was originally designed to last 1 year but due to COVID-19 related disruption it ran for 2 years, from December 2019 until June 2021. Implementation processes were adjusted accordingly, which afforded new insights into the conditions for effective intervention design and implementation. The trial sample comprised 789 children in 99 schools in the Bradford area. Children were screened in the Autumn Term of Reception year, with glasses ordered and delivered by early in the Spring Term.

The impact evaluation took the form of a randomised controlled efficacy trial comparing GiC (treatment) versus business as usual (BAU; control). The implementation and process evaluation (IPE) included six case studies of intervention schools. Surveys were undertaken with three different groups of participants: VCs (treatment only), teachers (treatment/BAU control) and parents (treatment/BAU control) and interviews took place with community optician teams and the developer.

Table 1: Key conclusions

Key conclusions
Children in the Glasses in Classes (GiC) treatment schools made no additional months' progress in reading compared to children in the business as usual (BAU) control schools. This result has a moderate security rating.
Exploratory analysis suggests that children in the GiC treatment schools did not have improved visual acuity compared to children in the BAU control schools, although both groups showed some improvement. Children who were offered GiC also did not show any improvement in the other secondary outcomes of reading decoding, auditory processing, and phonetic coding (Word Attack subscale) and quantitative knowledge, mathematical achievement, and quantitative reasoning (Applied Problems subscale).
Children eligible for Free School Meals (FSM) who were offered GiC made the equivalent of 1 months' progress in reading. Children eligible for FSM who were offered GiC did not show any improvement in the secondary outcomes of: 1) visual acuity; 2) reading decoding, auditory processing, and phonetic coding; and 3) quantitative knowledge, mathematical achievement, and quantitative reasoning, compared to children in the BAU control schools. However, these results have high statistical uncertainty.
Over 95% of teachers surveyed were supportive of the GiC intervention and would recommend it to other schools. Of the vision coordinators (VCs) surveyed, 80% thought that GiC enabled better focus on schoolwork; half thought GiC helped to improve academic performance and over one-third perceived positive effects on children's psychological well-being.
The impact of the COVID-19 pandemic on schools, families, and optical services disrupted both programme delivery and aspects of the evaluation. VCs and teachers interviewed generally believed that children may have not worn the glasses as much as expected and/or may not have completed remote learning activities and there was uncertainty about how pupil's academic progress has been measured during the lockdowns in 2020/2021 and the following recovery period.

EEF security rating

These findings have a moderate security rating (3 out of 5 padlocks). This was an efficacy trial, which tested whether the intervention worked under developer-led conditions in a number of schools. The trial lost 2 padlocks, one for attrition (13.9%) and one for threats to validity: disruption to the delivery of the intervention (caused by COVID-19) makes it harder to accurately estimate the size of the impact on the pupils in the trial.

Additional findings

Initial eye testing (refraction) and dispensing is critically important, and consideration should be given to where and how this should take place to best support glasses-wearing, should this or similar interventions be delivered at greater scale. The initial demand on local orthoptic services for vision screening in Reception class (year 1 of the study) was intense due to the design of the trial; typically, initial screening takes place over a much longer period.

Significant non-attendance at eye test appointments in year 1 of the study, more often by disadvantaged learners, affected the ability of the evaluation to detect primary and secondary effects. An in-school testing/dispensing approach could help to address this. There are cost implications for a school-based approach to testing and dispensing (as opposed to a high street opticians); however, this could increase the chances of ensuring that all children who need glasses get them.

Interviews and surveys indicated parental engagement as a potential area for improvement, most noticeable at the stage where children were prescribed glasses. In some cases, parents did not take children for their appointments. A small number of parents who disapproved of their children being given school glasses did not like the glasses that were being provided through the GiC programme. Parental engagement could be enhanced by more frequent reminders regarding the various stages of the programme's implementation and the potential benefits for their children of being involved, beyond the initial information package and consent form.

The VC role is important to the effective implementation of the intervention and greater consideration may be needed to what this role entails in different contexts. This is particularly important when several teachers in a single school setting are involved in the intervention and communication with parents and visions services requires greater coordination. The challenges associated with the COVID-19 pandemic (e.g. remote learning) were recognised by the largest number of VC respondents (63.9%). The next greatest challenge according to the VCs was difficulties in monitoring the programme's outcomes (i.e. using the tracker, 38.9%).

Teachers and VCs found the tracking of glasses-wearing challenging due to the number of pupils involved and/or the frequency of recording and digitising, on top of other roles and responsibilities. This increased during remote learning, which made it more difficult to monitor glasses use. Glasses trackers used in the evaluation were generally disliked and not completed well. In practice, this tracking process comprised paper forms, completed twice daily by the teacher or a teaching assistant (TA). These then needed to be digitised and securely transferred, a process that might be undertaken by the VC working with multiple teachers/TAs in larger schools. Future implementations of the intervention would benefit from better monitoring tools and participants suggested app-based or school information system approaches.

Cost

The average cost of the GiC intervention, had it been implemented fully as designed and planned, would have been approximately £220 per pupil over 3 years.

Impact

Table 2: Summary of impact on primary outcome(s)

Outcome/ group	Effect size (95% CI)	Estimated months' progress	The EEF security rating	No. of pupils	The EEF cost rating
Letter-Word Identification, full sample	-0.03 (-0.16, 0.10)	0		682	£ £ £ £ £
Letter-Word Identification, FSM-eligible group	0.09 (-0.12, 0.30)	1	N/A	185	£ £ £ £ £

CI, credible interval; EEF, Education Endowment Foundation; FSM, Free School Meals; N/A, not applicable.

Introduction

Background

Eyesight development in children occurs within the first 7–8 years of life, with the presence of reduced eyesight in young children potentially indicating conditions such as: 1) *refractive* error, which in children includes myopia (or short-sightedness), hypermetropia (or long sightedness), and astigmatism (where the shape of the cornea is not even); 2) strabismus (where the eyes do not line up in the same direction); and/or 3) amblyopia (also known as lazy eye).

There is compelling evidence of the association between vision problems in children and poor academic achievement. Furthermore, disadvantaged children experience higher prevalence of vision problems and are less likely to receive the treatment and eyeglasses they need (Glewwe, West, & Lee, 2018; Bodack, Chung, & Krumholtz, 2010). Improving the eyesight of young children has been shown to improve reading (Neitzel *et al.*, 2021; Bruce *et al.*, 2018a; Slavin *et al.* 2018; Solan *et al.*, 2004) though the evidence for the impact on mathematics is less compelling (Dudovitz *et al.,* 2020). Studies suggest that the *provision of glasses* to children, as a strategy, is more effective than merely the *provision of prescriptions* because it ensures that the children get glasses in the first instance (Evans, Morjaria, & Powell, 2018; Glewwe, West, & Lee, 2018). Some of these studies suggest that the initial benefits of the interventions fade over time.

As part of the Child Health Promotion programme (Department of Health, 2009), the UK National Screening Committee (UK NSC) recommends vision screening for children aged 4–5. Where the initial screening indicates reduced vision, parents are asked to arrange further diagnostic testing (refraction) at a high street optician or the local eye hospital. The school facilitates the initial vision screening by eye health professionals, but the results are not shared with the schools. (Note, this is the business as usual [BAU] situation in the Glasses in Classes [GiC] intervention.) The effectiveness of this process is dependent upon parents/caregivers arranging and attending eye test appointments. Children who do not attend follow-up ophthalmic examinations and those who do not wear their glasses are unlikely to improve their eyesight, affecting their early reading progression (Bruce *et al.,* 2018a).

In Bradford, approximately 15% of children screened are identified as having reduced vision. Of those requiring glasses, around a third do not obtain their required glasses due to not attending the high street optician or local eye hospital (Bruce & Outhwaite, 2013). Glasses-wearing in children from disadvantaged backgrounds is often low (Neitzel *et al.,* 2021) and even if a child does receive glasses, they can get broken, lost, or just not get worn in school (Messer, Mitchell, Twelker, & Crescioni, 2012). Solving vision difficulties is, therefore, not simply an issue of screening pupils or providing eyeglasses. The GiC intervention was designed to mitigate the weaknesses in the normal approach.

This study examines the impact of an intervention in which schools and teachers are enabled to actively support glasses wear. It comprises of three Key Components: 1) vision screening results are shared with schools[1]; 2) additional glasses are provided to, and retained in, schools; and 3) support mechanisms help to ensure regular wearing of glasses. Elements of the design have been previously studied in the Bradford setting (Bruce & Outhwaite, 2013; Bruce *et al.,* 2018a; Bruce, Sanders, & Sheldon, 2018b; Cassetti, Sanders, & Bruce 2019). Furthermore, in the autumn of 2021, the intervention was extended for further piloting and testing, either in its original form or adapted, to five opportunity areas within England: Doncaster; Derby; Durham; Norwich and Breckland; and North Yorkshire.[2]

Intervention

The Template for Intervention Description and Replication (TIDieR) for the GiC intervention is presented below. The intervention was originally conceptualised and commissioned as a 1-year programme for Reception year children between 4–5 years of age. Due to the disruptive impact of the COVID-19 pandemic this was extended to 2 years with the same cohort of pupils. Changes due to the pandemic are highlighted (below) with italicised text.

[1] Schools also hosted testing/dispensing service in the pandemic-impacted phase of the intervention.
[2] GOV.UK. (2021). Free Glasses to Tackle Poor Eyesight and Boost Literacy. Available at: https://www.gov.uk/government/news/free-glasses-to-tackle-poor-eyesight-and-boost-literacy (accessed 01/04/2022)

Why (rationale): The principal treatment for decreased visual acuity is the wearing of glasses (Cotter, *et al.*, 2012; Stewart, Moseley, Fielder, & Stephens, 2004) so children who do not attend ophthalmic examinations, or who do not wear their glasses, are unlikely to improve their level of visual acuity (Maconachie *et al.,* 2016) and might also be limiting their early development in English and mathematics. It is important to ensure, therefore, that children who need to wear glasses both obtain and wear them, whether at home or in school. Sharing the results of in-school vision screenings with schools should help teachers to support parents/caregivers through the eye health pathway, encouraging them to make and attend eye test appointments with their children and support their child to wear dispensed glasses. Ensuring that these children always have a pair of glasses to wear in school, and are encouraged to wear them, is also important for their visual acuity and for their learning progress.

Who (recipients): Reception year children received vision screening in Autumn Term 2019. Children for whom the vision screening suggested reduced vision in the schools were assigned to receive the school-based support and were compared to similar children in the BAU control schools.

From October 2020 to April 2021, children in the GiC intervention (treatment) arm received an updated eye test (refraction) from mobile community opticians to update prescriptions and reach a wider proportion of the participating trial children. Only those identified in Autumn Term 2019 in potential need of glasses were retested in order to maintain continuation of the original trial protocol that excluded 'joiners'. This two-person team provided ***a complete*** *eye test (refraction)* ***and glasses dispensing service*** *in contrast to the Autumn Term 2019 approach, which utilised a referral to specialist clinical pathway (Hospital Eye Service) or community opticians as appropriate. Children in the BAU control arm continued to receive community-based eye care from the clinical pathway or community opticians as appropriate in writing to parents/legal guardians without involvement of the school.*

What (materials): The following materials were provided: training materials for school staff; campaign materials for families; secure and General Data Protection Regulation (GDPR) compliant systems for recording withdrawals from the project; sharing data and tracking progress on the referral pathway; school-based system to ensure children wear their glasses in school; spare glasses were made available as needed; and an attendant monitoring process for wear.

In September 2020, updated training material and training for school staff was provided, which reflected the change in approach. In addition, updated information sheets for parents/legal guardians were provided.

What (procedures): Vision screening results were recorded, and letters were sent to parents with instructions to go to the optician for further assessment/treatment as appropriate. If the child attended the appointment and the initial screening diagnosis was confirmed, they received a pair of 'home' glasses (i.e. BAU). For the intervention, a second pair of glasses was sent to the school and made available for the child to wear in the classroom. The results of the vision screening were shared with the vision coordinators (VCs) and over the course of the year, teachers were expected to encourage those children prescribed glasses to wear them, and that spare pairs were available if children attended school without their home pair, as well as working with parents/caregivers through typical daily interactions to encourage glasses wear at home. Parents were asked to report to schools if the home glasses got lost or broken and asked them to attend the optometrist[3] with their children for the fitting of the replacement glasses. School glasses replacement were organised by the intervention team, once informed by the school and this was monitored by the developer. VCs were trained (after pre-tests were completed).

As above, parents/legal guardians received an updated information sheet (see Appendix B), with the right to withdraw their children from the study at any time. Children in the intervention group then received updated eye tests (refraction) and new glasses were ordered as appropriate. Children in the BAU control group received usual practice invites from community opticians or clinical pathway as appropriate.

Who (implementers): Distributing information sheets and recording withdrawals were the responsibility of a designated school 'VC'—usually members of the senior management team or class teachers, but also included teaching assistants

[3] For a glossary of specialist terms please see Appendix A.

(TAs) and Special Educational Needs Coordinators (SENCO). Reception year staff were responsible for checking and ensuring identified children wore glasses during the school day.

How (mode of delivery): Information sheets and withdrawal forms were distributed to allow the sharing of prescription data for all Reception year children, and all Reception year children to receive an in-school vision screening. Families of children whose vision screening identified potential vision problems were prompted in writing by the local health teams, and in person by the VCs, as needing to attend refractive appointments and obtain glasses for home wear. School staff, using spare glasses if personal pairs were not present in the school, would ensure glasses were worn in class.

As discussed above, in Autumn Term 2020 updated information sheets and withdrawal forms (see Appendices) were issued to parents/legal guardians. Those children in the intervention group who had previously been identified as needing glasses received a further eye test by mobile community opticians and had their two pairs ordered and dispensed in school by the dispensing mobile optician, if deemed appropriate. Parents/guardians were provided with the prescription (if requested) should they wish to choose glasses for their child. Children in the BAU control group continued to have high street testing and dispensing.

Where (setting): In school (vision screening), in health services settings (hospital eye department—refractive appointment and community optometrists—refractive appointment, dispensing and fitting of all glasses for both home and school use) and in Reception year and Year 1 classroom settings (wearing spare glasses).

From October 2020 to April 2021 (due to the January–March lockdown), community optometrist services' refractive appointments, dispensing and fitting of all glasses were replaced by in-school refractive appointments, dispensing and fitting of all glasses performed by mobile community optometrists to improve take up of glasses at home and at school.

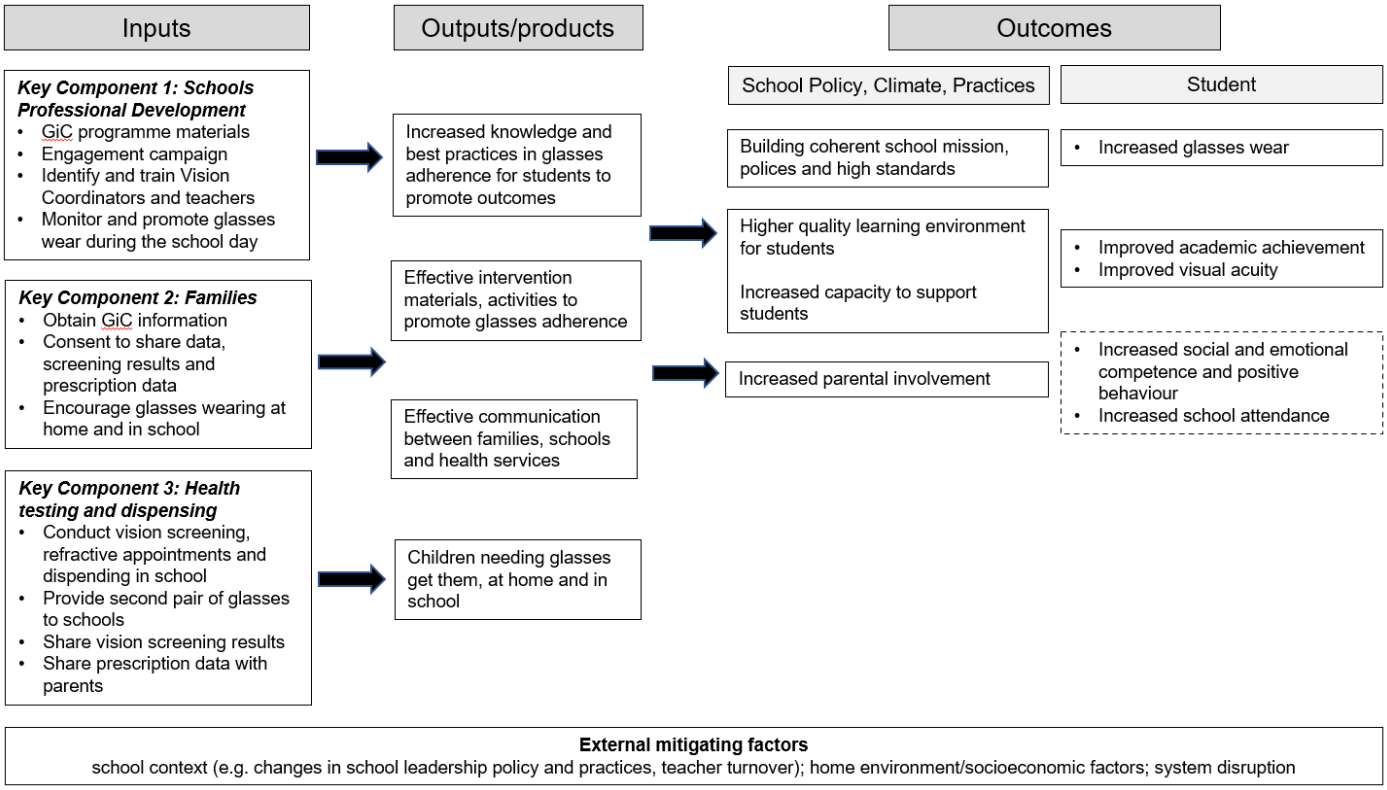
When and how much (duration and dosage): The intervention was promoted to parents prior to the beginning of the Reception year. Information sheets and withdrawal forms were distributed to allow the sharing of vison screening data collected in September 2019 and October 2019 of Reception year (i.e. by putting forms in book bags and promoting through typical contact with parents/caregivers). Glasses were ordered from November 2019 onwards and the provision of spare glasses to intervention schools took place by January 2020. For the remainder of the intervention (5 months) children's glasses wear was tracked via a twice-daily check, usually linked to registration.

From October 2020 the delivery of new glasses to schools was extended to April 2021. For the entire period, children's glasses wear (2019/2020, and 2020/2021 prescriptions) was monitored via a daily check, typically linked to morning registration.

Tailoring (adaptation): Schools were able to adapt the process for daily checking that the children who had been prescribed glasses were wearing them to better align with their method of registration (such as by paper or via electronic means). They were also able to introduce various approaches to ensuring follow-up appointments were met, including accompanying children to hospital or optometrist appointments as appropriate.

The revised, pandemic-adjusted version of the logic model is shown in Figure 1a. The original pre-pandemic version of the logic model is shown in Figure 1b below. The key changes can be seen in Key Components 2 and 3.

a



b

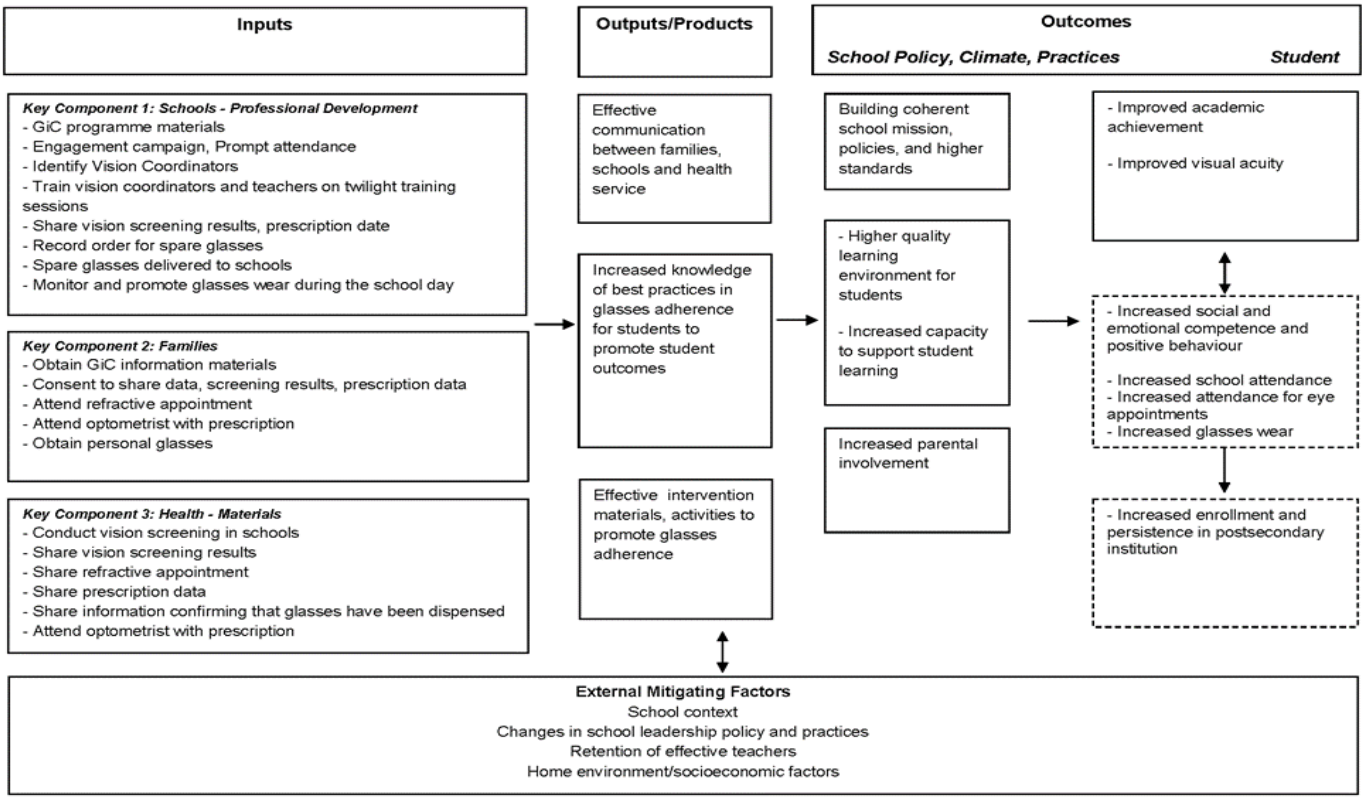


Figure 1: Glasses in Classes (GiC) logic model (a) adapted pandemic-adjusted design, (b) initial pre-pandemic design

Evaluation objectives

The GiC evaluation sought to address the following research questions. These were set out in the evaluation protocol and discussed further in the Statistical Analysis Plan.

The impact evaluation addressed the following primary research question:

1. What is the impact on the reading achievement (Letter-Word Identification) of pupils after their first 2 years[4] of school participating in GiC as opposed to participating in the BAU control group?

In addition, the impact evaluation examined the following exploratory secondary research questions:

2. What is the impact on the mathematics and reading achievement (Word Attack) of pupils in their first 2 years of school participating in GiC as opposed to participating in the BAU control group?
3. What is the impact of GiC in comparison to the BAU control group on children's mathematics and reading achievement among pupils eligible for Free School Meals (FSM) (defined as any pupil who has ever been classified as in receipt of FSM)?
4. What is the impact on the visual acuity of pupils in their first 2 years of school participating in GiC as opposed to participating in the BAU control group?

The implementation and process evaluation (IPE) sought to answer these further questions:

5. What extent are key components of GiC implemented with fidelity across intervention schools? And what are the key factors that facilitate and hinder the implementation of GiC with fidelity across intervention schools?
6. What percentage of GiC intervention schools have high fidelity of implementation according to the fidelity of the implementation protocol?
7. What strategies do teachers use to encourage the wearing of glasses, in (high/low fidelity) intervention and BAU control schools?
8. What strategies do VCs use to encourage wearing of glasses?
9. How do headteachers, VCs, teachers, and parents perceive the effectiveness of GiC?
10. Are there any unintended consequences of GiC in the intervention group?
11. What types of structures and partnerships need to be in place to help deliver GiC to large numbers of schools at scale?

Ethics and trial registration

The GiC intervention relied on the collection of sensitive eye health data, as well as academic achievement data for young children in Reception year and Year 1 at two time points—prior to randomisation and post-intervention. As such, two ethics approvals were sought, first for health data through the Health Research Approvals process (IRAS 253681), and second for education data through the University of Nottingham's School of Education Review Board (CPMS 41579). Both ethical review panels approved the study. As noted above, with the extension of the project due to COVID-19, ethics was updated by both review boards in August 2020.

The trial was publicly registered in the International Standard Randomised Controlled Trial Number (ISRCTN) Registry at www.controlled-trials.com, (reference number: ISRCTN23508254).

[4] The '2 years' is atypical and heavily disrupted due to the COVID-19 pandemic as the initial plan was for a 1-year intervention.

Schools and parents were provided with information sheets and privacy notices (see Appendices) describing why and how the study would be conducted, justifying the information to be collected, and setting out the basis for processing the data. Additional forms were provided to the parents to allow them to withdraw their children from the study.

Data protection

The research complied with the Data Protection Act (2018) and GDPR (2016). The project has at all times complied with University of Nottingham and Bradford Teaching Hospitals NHS (National Health Service) Foundation Trust ethical standards. We processed data under the legal basis outlined in Article 6(1)(e): 'necessary for the performance of a task carried out in the public interest or in the exercise of official authority' (GDPR, 2016). For special category data our additional legal justification for processing, as required by Article 9 of the GDPR, is Article 9(2)(j): 'processing is necessary for archiving purposes in the public interest, scientific or historical research purposes or statistical purposes in accordance with Article 89(1)' (GDPR, 2016).

The research team ensured appropriate data safeguards, processing the minimum necessary data, utilising pseudonymisation techniques and ensuring data is collected and stored in a secure manner as outlined by the University of Nottingham's Handling Restricted Data Policy. All research participants were provided with a privacy notice highlighting how we will use the data they provide at the start of the trial and issued a further information sheet with the extension of the project.

In line with University of Nottingham standards, the university may store the data for up to 25 years after the project. Data will continue to be stored securely in a password-protected SharePoint folder that is accessible to authorised persons only. Names of children and schools will not be released in associated research reports. The data was shared with the Department for Education (DfE) for the purpose of matching to the National Pupil Database (NPD), and in anonymised form with the Office for National Statistics (ONS) acting as data processor for the DfE. The data will be shared with the Education Endowment Foundation (EEF), the EEF's archive manager, and potentially other research teams in the future, subject to the appropriate approvals. Further matching to the NPD and other administrative data may take place during subsequent research to better understand the impact of the project.

The trial parties had the following roles and responsibilities in the collection and management of data:

- The University of Nottingham acted as data controller throughout the evaluation period. This will include up to and including successful submission of evaluation data to the archive (having passed internal FFT checks) and deletion of the data.
- Bradford Institute for Health Research and the University of Leeds acted as joint data controllers up to the point of data archiving and deletion. In the case of the achievement data, Bradford Institute for Health Research and the University of Leeds are data processors.
- The EEF will act as the data controller for the archive, which is managed on their behalf by FFT and held in the ONS Secure Research Service (SRS). The archive does not contain any information that can be used to directly identify an individual pupil. For example, the archive does not include names, addresses, or dates of birth. The archive does contain the Pupil Matching Reference (PMR), which is an identifier used by the DfE to enable the linking of archive data to the NPD.

Project team

The team comprised of the following:

- Professor Roisin P Corcoran, Principal Investigator (December 2018 – February 2021), and Professor of Education at the University of Nottingham, led the initial design and set up stages of the project providing the background expertise, and managed the research team and stakeholder relations.
- Professor Andrew Noyes, Principal Investigator (March 2021 – present), and Professor of Education at the University of Nottingham, led the latter stages of the project, overseeing the team, evaluations, stakeholder relations, reporting, and dissemination.

- Dr Michael Adkins, Co-Investigator, and Senior Research Fellow at the University of Nottingham, carried out the data analysis of the impact evaluation and assisted with report writing.
- Dr Stanimira Taneva, Research Associate at the University of Nottingham, led the IPE work and contributed to the report writing.
- Alex Phillips and James Fox, Administrative Officers, were responsible for project management and coordinating day-to-day aspects of the project, under the direction of the principal investigator. This included maintaining contact with schools, survey data collection, coding, GDPR compliance, and recruitment materials.

The delivery team comprised of the following:

- Dr Alison Bruce, Director of Vision Research at the Bradford Institute for Health Research and Bradford Teaching Hospitals NHS Foundation Trust, led the delivery of the study, research design, data collection, and data transfer to the evaluation team.
- Professor Mark Mon-Williams, Chair in Cognitive Psychology at the University of Leeds, Professor of Psychology at the Bradford Institute of Health Research, and Professor of Paediatric Vision at The Norwegian Centre for Vision, was the adviser to the delivery team and link to the Born in Bradford data platform.
- Dr Emily Williams, Research Fellow at the University of Leeds, was responsible for GiC delivery processes and school engagement.
- Dr Shegufta Farooq, Research Fellow based at Bradford Institute for Health Research, was responsible for GiC delivery processes, school engagement, and assisting with visual acuity data collection.
- Jenny Cheung-Crossley, Sunyia Raouf, and Hafsah Hussain, Specialist Orthoptists, who were responsible for coordinating the vision screening team (research orthoptists) and responsible for liaising between community- and hospital-based ophthalmic services.
- Research orthoptists were responsible for vision screening in schools as directed by the specialist orthoptists and research fellows including data collection and GDPR compliance. They worked alongside the ophthalmic clinical team from Bradford Teaching Hospitals NHS Foundation Trust.

Methods

Trial design

The GiC evaluation was planned as an efficacy study for approximately 700 pupils nested in 100 schools. The study was based on current guidance for UK vision screening[5] with the pre-intervention visual acuity test provided for the whole Reception year group, before narrowing the focus to those who were unable to achieve (screen positive) a visual acuity in either eye of 0.2 Logarithm of the Minimum Angle of Resolution (logMAR). Those pupils then received pre-intervention academic testing using three subscales of the Woodcock-Johnson IV (Schrank *et al.,* 2014) suite of tests and discussed further below. School clusters were then randomised by the evaluator's project statistician to receive the intervention arm or the BAU control arm with a 0.5 probability of receiving the GiC intervention. At the design stage of the evaluation, the aim was to recruit pupils from 100 schools, with an average cluster size of seven pupils. Schools were recruited from the Bradford Metropolitan District from initial expressions of interest. Once the parents had consented, pupils received vision screening and full pre-testing was completed, schools were randomised into the two-arms on 14th December 2019.

Table 3 outlines the outcomes, measures, and sample relevant to the study.

Table 3: Trial design

Trial design, including number of arms		Two-arm, cluster randomised
Unit of randomisation		School
Stratification variable(s) (if applicable)		Not applicable
Primary outcome	Variable(s)	Reading achievement
	Measure(s) (instrument, scale, source)	Woodcock-Johnson IV Letter-Word Identification (continuous), Test B, age-adjusted scores. Measure was evaluator administered. Standard range for Woodcock-Johnson IV academic achievement scales is 40 to 130. Scores beyond 130 are exceptional
Secondary outcome(s)	Variable(s)	Reading achievement, mathematics achievement, visual acuity
	Measure(s) (instrument, scale, source)	Woodcock-Johnson IV Word Attack (continuous) and Woodcock-Johnson IV Applied Problems (continuous), Test B, age-adjusted scores; Logarithm of the Minimum Angle of Resolution (logMAR) (continuous). Measures were evaluator administered. Standard range for Woodcock-Johnson IV academic achievement scales is 40 to 130. Scores beyond 130 are exceptional. logMAR range: -0.30 to 1.6
Baseline for primary outcome	Variable(s)	Reading achievement
	Measure(s) (instrument, scale, source)	Woodcock-Johnson IV Letter-Word Identification (continuous), Test A. Measure was evaluator administered. Standard range for Woodcock-Johnson IV academic achievement scales is 40 to 130. Scores beyond 130 are exceptional
Baseline for secondary outcome(s)	Variable(s)	Reading achievement, Mathematics achievement, Visual acuity

[5] GOV.UK. (2019). Child Vision Screening. Available at: https://www.gov.uk/government/publications/child-vision-screening (accessed 01/04/2022)

	Measure (instrument, scale, source)	Woodcock-Johnson IV Word Attack (continuous) and Woodcock-Johnson IV Applied Problems (continuous), Test A, age-adjusted scores; logMAR (continuous). Measures were evaluator administered. Standard range for Woodcock-Johnson IV academic achievement scales is 40 to 130. Scores beyond 130 are exceptional. logMAR range: -0.30 to 1.6

Participant selection

All regular state primary schools (academies, free schools, and local authority managed) from the Bradford Metropolitan District with a Reception class were eligible for inclusion. All children were eligible within the Reception year for vision screening (as per standard practice). As discussed above, the main impact analysis focused on children for whom the vision screening test identified vision problems in the intervention group compared to similar children from the BAU control group.

Outcome measures

The outcome measures for the primary and secondary outcomes were the Woodcock-Johnson IV Letter-Word Identification, the Woodcock-Johnson IV Word Attack, Woodcock-Johnson IV Applied Problems (Schrank, McGrew, Mather, & Woodcock, 2014), and logMAR. The Woodcock-Johnson instruments have been selected as they satisfy What Works Clearing House standards (WWC, 2017). Specifically, the tests demonstrate face validity and reliability and are not over-aligned with the intervention and were to be administered in the intervention and BAU control groups with testers blind to the treatment status of the school. Test A was used for the academic baseline measure and Test B was used for the post-test outcomes.

Test administrators were recruited from the local area from a local supply teacher agency and trained to use the Woodcock-Johnson IV tests by an external educational psychologist with expertise in the tests. Visual acuity was measured by the vision screening team; clinical orthoptists from Bradford Teaching Hospitals NHS Foundation Trust, supplemented by orthoptists recruited by the developer in order to complete the vision screening of the 100 recruited schools within a condensed time period (3 months). For the first testing period, academic testing was completed after the visual acuity screening after notification of which children had been further referred for a diagnostic eye test (refraction) following vision screening. For the post-testing period, teams entered schools together to minimise the burden on schools, specifically minimising the amount of people moving in and out of school with the challenging backdrop of the pandemic. As children completed the visual acuity screening, this was followed immediately by the academic tests. A local temporary office was set up in Shipley near Bradford in the two testing periods in order to: facilitate the distribution of tests and ensure data protection; and secure transfer of data back to the evaluation team. Testers were blind to treatment arms for both academic and visual acuity testing.

Primary outcome

The Letter-Word Identification subscale is designed to test reading and decoding. Each pupil is provided with visual stimuli (i.e. text) and are required to identify printed letters and words. The response is oral (i.e. letter names and words). Letter-Word Identification was chosen as the primary outcome measure based on prior research with a similar population (Bruce *et al.,* 2018a).

Secondary outcomes

The Word Attack subscale is designed to test reading decoding, auditory processing, and phonetic coding. The stimuli are visual (i.e. words) and pupils are tasked to read phonically and provide pronunciations of pseudo words (McGrew et *al.,* 2014, pp. 127–128). Applied Problems tests quantitative knowledge, mathematical achievement, and quantitative reasoning. Pupils are provided with auditory questions and visual stimuli (i.e. numeric and text) and are required to perform mathematics calculations, providing an oral response comprising of numbers and words. For the analyses of all three Woodcock-Johnson IV subscales, raw scores were converted to age-standardised scores.

The Keeler crowded logMAR test is the recommended test for performing vision screening in young children. Visual acuity was measured by the developer at a 3-metre distance using the LogMAR Crowded Test, with four letters per line, and each letter designated a score of 0.025; therefore, the score total per line represents 0.10 log unit. (The lower the

score the higher the visual acuity.) A matching card is used when testing children aged 4 to 5 years, therefore knowledge of letters is not a prerequisite for test performance.

Baseline measures

Pupil pre-test measures used the outcome measures discussed above with all pupils in Reception year receiving a logMAR screening test carried out by orthoptists from the Bradford delivery team. Those scoring a logMar of greater than 0.2 were triaged and sent for a full eye examination with high street optometrists in the Bradford Metropolitan District, or where appropriate the local eye hospital. In addition, as discussed above, the evaluation team academic test administrators carried out Test A for the Woodcock-Johnson IV Letter-Word Identification, Applied Problems, and Word Attack subscales.

Randomisation

The design involved a randomised multi-level/hierarchical trial, with school-level randomisation using a simple randomisation process. Pupils were pre-tested by vision screeners and a trained academic testing team recruited locally from a teacher supply agency during September 2019, October 2019, and November 2019 with a temporary local office set up to process the returned tests. Raw test scores were entered into the Woodcock-Johnson IV server for standardisation and the test scores recorded. School assignment was completed on 14th November 2019 for a total of 100 schools (50 BAU control, 50 treatment). One school was withdrawn after randomisation, but before notification as it was ineligible due to being an independent school. The *R* code for randomisation is provided in Appendix C.

Statistical analysis

Our analysis as set out in the Statistical Analysis Plan[6] modelled the effect of the GiC intervention on the basis of intention-to-treat using a series of linear multi-level analyses estimated by Bayesian inference for both the primary and secondary outcomes (see Appendix J for discussion on key benefits of Bayesian vs classical 'frequentist' approaches). The analysis was conducted in the ONS SRS, which acts as the data processor on behalf of the DfE. Researchers securely log on via a safe setting and outputs go through statistical disclosure control.

Throughout the primary, secondary, subgroup, and missing data analysis, we used the following default priors: normal priors with a mean of 0 and standard deviation (SD) of 2.5 on the intercept and the coefficients; exponential priors with an SD of 1 on the error term; and a Lewandowski-Kurowicka-Joe prior on the covariance matrix. The use of auto-scaled weakly informative priors is for what is referred to as regularisation, i.e. improving the efficiency of the mixing of the algorithm rather than acting as an informative prior to exert influence on the estimates derived from the posterior distribution (for a basic discussion of the default priors and prior distribution choices see Gelman, Hill & Vehtari, 2021, pp. 119–127).

Primary analysis

The primary outcome was the average difference in the post-intervention standardised score on the Woodcock-Johnson IV Letter-Word Identification Test B between the group receiving the GiC intervention and the BAU control group. It is represented by the regression equation set out below and we describe the parameters here. The pupil level of the model has a grand mean of the Letter-Word Identification standardised score post-test (represented by β_0), which we allow to vary by membership of school (represented by the parameter u_{0jk}, which adjusts the intercept for each school average); a school-level binary treatment covariate, which is entered at the pupil level where 0 represents those pupils who received the BAU control condition and 1 represents those pupils who received the GiC intervention; a normally distributed and mean-centred pre-test covariate (the standardised score on the Letter-Word Identification Test A), and finally the pupil level normally distributed error term (ε_{ijk}). For the school-level error term, we assume that this is normally distributed with a mean of 0, and we estimate the variance (σ^2_{School}).

[6] Education Endowment Foundation. (2022). Glasses in Classes. https://educationendowmentfoundation.org.uk/projects-and-evaluation/projects/glasses-in-classes

$$y_{ij} = \beta_0 + \beta_1 Treatment_i + \beta_2 Pre-test_i + u_{0j} + \epsilon_{ijk}$$
$$u_{0j} \sim N(0, \sigma^2_{School}) for\ j = 1 \dots J$$
$$\epsilon_{ijk} \sim N(0, \sigma^2_{\epsilon}) for\ i = 1 \dots N$$

Secondary analysis

The three secondary outcomes set out in Table 3: Woodcock-Johnson IV Word Attack subscale standardised score, Woodcock-Johnson IV Applied Problems subscale standardised score, and logMAR—for the worst and best eye at post-test, with the same eye at pre-test, were modelled using the same specification as the primary analysis on the basis of intention-to-treat. Effect sizes were estimated using the same method and formula presented below.

Analysis in the presence of non-compliance

In the protocol and Statistical Analysis Plan, an instrumental variables approach was set out, which would create a dichotomous indicator of compliance at the pupil level derived from three subdomains of indicators at the school level and pupil level:

- Key Component 1: Schools—Professional Development Indicator. Attendance at the VC training (1 day) involves: a score of 0 if no VC attends the 1-day training; a score of 0.5 if the VC views a recording of the training; and a score of 1 if the VC attends the training in person or online. Implementation with fidelity is given a score of 1.

- Key Component 2: Schools—Pupil Optometrist Attendance Indicator. Child attendance at a community optometrist appointment. Scored at the school level as: 0 where less than 80% of children attend; 1 where 80–89% of children attend; and 2 where 90–100% of children attend. Implementation with fidelity is given a score of 2.

- Key Component 3: Child—Materials Indicator. Whether the child had a full set (two pairs of glasses). Pupils were scored as: 0 for no glasses issued; 1 for an incomplete set (e.g. one pair); and 2 for a full set (e.g. two pairs). Implementation with fidelity is given a score of 2.

Even where a school was compliant the critical element of compliance for intervention was that children receive a full set of glasses—one for home/school wear, and one as a school-based back up pair. Therefore, it was a priority to treat the compliance indicator at the pupil level.

To carry out a Complier Average Causal Effect analysis, a Bayesian two-stage least squares analysis was planned using a dichotomous indicator of full fidelity versus incomplete fidelity, with the model specified below:

$$Compliance\ y_i = \beta_{0i} + \beta_1 Treatment_i + \beta_2 Pretest\ Outcome_i + u_{0j} + \varepsilon_i$$
$$Posttest\ Outcome\ y_i = \beta_{0i} + \beta_1 Compliance\ \hat{y}_i + \beta_2 Pretest\ Outcome_i + u_{0j} + \varepsilon_i$$

If there were issues where schools were not meeting adequate thresholds on Key Components 2 and 3, then the raw percentage of attendance would be used and a Jenks natural breaks optimisation (Jenks, 1967) to determine clusters of schools' compliance on optometrist attendance. Unfortunately, there was considerable missingness on Key Components 2 and 3. In year 1 of the study, the data was collected by the developer and received from 18 schools for 64 schools up to lockdown. In year 2 of the study, it was collected by the evaluator from 34 schools and for 262 pupils. As such we have not opted to model this formally but have provided a descriptive account of the data and missingness, which is discussed in the Results section below.

A dosage analysis was also considered. However, setting the BAU control group to a value of 0 for no dose was not realistic as the BAU control group children had the opportunity to be taken for a high street eye examination and the potential to be prescribed one home/school pair. Essentially in this case, BAU is not, no treatment received. Furthermore, a third of the intervention group were still missing from this data.

Missing data analysis

First, a descriptive comparison of missingness in both arms was carried out to calculate the differential attrition. Second, a multi-level logistic regression model of missing was also fitted to understand the probability of missingness for the outcome, being fitted classically using the R package *lme4*. A two-level multi-level joint modelling imputation model was fitted using the primary model's and academic secondary Woodcock-Johnson IV outcomes, the three academic Woodcock-Johnson IV covariates, school index, and two further auxiliary variables—FSM and Gender using the Joint Modelling package *Jomo* in R. The sampler was run for 5,000,000 iterations, generating four imputed datasets. Visual checks and potential scale reduction factors (specifically looking for values of 1.01 or less) were assessed for evidence of convergence. The imputed datasets were extracted, and the primary model was fitted, and posterior distributions combined. The appropriate summary statistics were generated, along with effect sizes.

Subgroup analyses

An additional multi-level interaction model following the form presented below was fitted to examine the impact of the intervention on FSM recipients. This used the FSM flag in the NPD rather than FSM6 as the children involved are in the first 2 years of primary school.

$$y_{ij} = \beta_{0j} + \beta_1 Treatment_{ij} + \beta_2 Pre{-}Test_{ij} + \beta_3 FSM_{ij} + \beta_4 Treatment{*}FSM + u_{0j} + \varepsilon_{ij}$$

$$u_{0j} \sim N\,(0, \sigma^2_{school})$$

$$\varepsilon_{ij} \sim N\,(0, \sigma^2_{y})$$

Additional analyses and robustness checks

As pre-specified in the Statistical Analysis Plan, if there was a practically significant treatment effect on the Woodcock-Johnson IV and visual acuity measures, we would carry out an additional mediation analysis based on the Baron and Kenny (1986) approach. As this condition was not met, we did not model this mediation analysis. In addition, we had intended to carry out a dosage analysis, but unfortunately, the returns from the BAU control condition via high street opticians were very poor with 29% missingness in year 1 of the study and 92% missingness on when glasses were dispensed to pupils. In the treatment group in year 1 of the study, approximately 30% had missing data or no glasses issued, although this improved dramatically in year 2 of the study (91%). We have explored dosage descriptively and discuss this further below. Finally, we fitted the models classically as a sensitivity analysis to the Bayesian approach employed.

Estimation of effect sizes

Effect size estimation took advantage of the Bayesian approach, which allows for the full information of the posterior distribution. We post-processed the posterior simulations returned as part of our fitted model to generate effect size quantities of interest. This has the benefit of being able to compute direct probabilities of certain effect sizes, calculate a Region of Practical Equivalence (ROPE), and average effect with 95% credible intervals. The ROPE (Krushke, 2018, p. 270) provides a set of rules to allow the research to judge whether the evidence within a Bayesian posterior distribution is practically different from a null value. It calculates a user set highest density interval where the majority of the range of credible values fall (in our case set to between 2.5% and 97.5%) and an effect size range, which we set to ±0.1 or half of a small effect. If the values fall within the effect size range, we can accept the null value, if they fall outside that range we can reject the null value, and if the evidence is mixed then a decision is withheld. Not only should the 95% uncertainty interval be bound away from zero, but for something to be practically significant it should be bound away from 0.1.[7]

[7] The posterior distribution is the product of our existing knowledge and the data. In this case, we have specified we have very weak knowledge, so the data dominates the resulting 'posterior' distribution. Any prior information is for regularisation—promoting effective fitting of the model only. Probability of direction is an index of how much certainty one has in terms of the direction of an effect. It

Our equation for Hedges' g effect sizes is set out below, where the numerator of $\overline{Yt}$ - $\overline{Yc}$ is the mean difference in Woodcock-Johnson IV post-test scores between the treatment and BAU control group, and the denominator ($\sigma^2 School,\ and\ \sigma^2$) is the square root of the two unconditional variance parameters for the school level and pupil level:

$$ES = \frac{\bar{Y}_T - \bar{Y}_C}{\sqrt{\left(\sigma^2_{school} + \sigma^2_y\right)}}$$

Estimation of intracluster correlation coefficient (ICC)

ICCs were calculated for the primary outcome and secondary outcomes measures, along with the associated pre-test measures using a variance components multi-level model estimated by Bayesian inference. This is an empty model, which estimates the grand mean, along with the variance at the school level, and the residual variance. The latter two parameters were extracted from the posterior distribution to calculate the statistic using the following equation:

$$ICC = \frac{\sigma^2_{School}}{(\sigma^2_{School} + \sigma^2_e)}$$

Longitudinal analysis

Since the study protocol was published, the EEF has contracted a team at Durham University to conduct longitudinal analyses of all the EEF trials in the archive, therefore the Key Stage 2 data from NPD will be linked and analysed for this trial as part of this work.

IPE

As part of the mixed-methods design of the evaluation, an IPE was developed to complement the impact evaluation. The initial IPE was revised part way through to account for changes in the project context (i.e. the COVID-19 pandemic).

IPE aims and approach

The purpose of the IPE was to understand the roles of community opticians, VCs, teachers, and parents in implementing the GiC intervention and understanding the barriers to, and facilitators of, effective implementation. A survey of existing practices at the start of the project informed the design of later IPE instruments.

A group of six case studies were developed that combined interviews with senior leaders and VCs with other publicly available information on the schools and survey data from the project. These were triangulated with intervention-wide surveys of teachers from across participating schools and VCs in intervention schools (as such a role does not exist in the BAU control schools). In the updated design, the project team surveyed parents rather than undertake the planned focus group discussions. Due to the differing scales of primary school engagement (i.e. 1–25 participating children; 1–3 classes), the roles of teacher/VC/senior leader were sometimes conflated. A key aspect of the IPE was the monitoring of glasses wear using glasses trackers, a two-part process by which teachers: 1) used paper forms twice daily to record glasses wear (normally linked to registration); and then 2) digitised these before submitting to the evaluation team. While the data was subject to significant missingness, it was used to generate a measure of 'fidelity', which in turn, informed the sampling of case study schools.

IPE sampling and recruitment

Case studies

does not address the magnitude of an effect, which is better presented by the ROPE. Probability of direction is a transparent Bayesian version of the frequentist p-value (see Makowski, Ben-Shachar, Chen, & Lüdecke, 2019).

The case study approach was incorporated in the IPE's mixed-method design to examine in greater depth the experiences and perceptions of the key school staff (senior leadership team [SLT] and VCs) of the programme's quality, implementation process, and outcomes (research questions 5–9; see Table 15). In April 2021 and May 2021, six schools were selected based on their level of engagement and compliance with the GiC programme, for example on how responsive they were to return glasses tracker data, and their level of engagement with the delivery team. In May 2021, a total of 11 semi-structured interviews representing 12 staff positions in the six schools were conducted. These included six VCs and seven representatives of the SLT. In one of the schools, the VC and the representative of the SLT were the same person. In another school, two SLT members attended the same interview. To further inform the development of the case studies, the programme participation records for each school were reviewed. Four out of the six case study schools were based in Bradford, and two (both 'high fidelity') were in more rural areas in the City of Bradford. Four schools are of a 'community school' type, one ('high fidelity') is a 'free school', and one ('high fidelity') is an 'academy converter'.

IPE data collection

Pre-intervention surveys with schools (Appendix D): Prior to the intervention (in 2019), an online survey was sent to the VCs in 99 participating schools to understand how teachers perceived school-based pupil vision services (i.e. provision of eye tests and/or treatment including glasses). The survey focused on two aspects: 1) the (then) current situation of pupils wearing glasses and teachers' strategies to encourage the wearing of glasses at all times; and 2) perceptions on the (then) current vision service programme. The pre-intervention survey helped to identify the barriers to pupils wearing glasses and how well the current national vision services programme integrated with the local schools, teachers, parents, and pupils.

Post-intervention surveys with teachers (Appendix G) and VCs (Appendix H): In May 2021 and June 2021, two surveys (for teachers and VCs) were designed and implemented to explore in more detail the use of programme implementation strategies (research questions 7 and 8) as well as the wider programme-related perceptions (research questions 7–11) of those most directly involved in the programme's implementation in schools. Both survey designs were informed by analysis of the pre-intervention data and included quantitative (i.e. multiple-choice) and qualitative (i.e. open-ended) questions. The teacher survey was informed by the empirical outcomes of pre-intervention survey versions, used to evaluate aspects of the programme's implementation process at earlier stages (in 2019). The VC survey was driven by data interpretations from the case study interviews with VCs (in 2021). Both surveys were administered online through the survey platform Qualtrics in June 2021. To allow comparisons of strategy use, the teacher survey was administered to both intervention and BAU control schools.

Post-intervention survey with parents (Appendix F): Following adaptations of the original project study protocol in early 2021, the parent survey (June 2021) was designed to replace the planned (2019) focus group with parents, in part due to the difficulties of assembling groups of parents in schools during the later stages of the pandemic. The survey included quantitative and qualitative questions aimed at exploring the parents' perceptions of the programme's effectiveness (research question 7) for both intervention and BAU control schools. Accounting for the higher numbers of parents from communities with English as an Additional Language (EAL) and to encourage higher participation, two additional language survey versions were developed in Urdu and Punjabi. The survey was administered to all schools, online via Qualtrics, in June 2021 and July 2021.

Interviews with the programme's developer and the community optometrist (Appendix I): Finally, to capture the perspectives of other key stakeholders of the programme's strengths, challenges, and potential future implementations (research questions 10 and 11), individual semi-structured interviews were conducted with the programme's developer (July 2021) and a representative of one of the three community optometrist teams (October 2021), collaborating on the programme's implementation.

IPE data analysis

All interviews were video or audio-recorded, with the permission of the study participants, then transcribed and anonymised. The survey data were collected with the informed consent of the participants and anonymised. The qualitative data (mostly interviews and project documentation) were analysed through employing a phenomenological psychological approach, where the focus is on exploring inductively the participants' authentic experiences of the GiC programme. Instead of relying on processes of categorisation and quantification, phenomenology focuses on describing

how things are experienced by the people directly involved (Denscombe, 2007) and is, therefore, suitable for the purposes of the IPE. Interview transcripts and other documents were analysed through an inductive thematic analysis procedure (Braun & Clarke, 2006; King, 2004) and the qualitative data analysis software NVivo Version 12 (QSR International Pty Ltd, Victoria, Melbourne, Australia) . A similar thematic analysis approach was applied to the qualitative survey data. The coding systems, developed for all qualitative investigations within the IPE, followed the typical template analysis guidelines (Braun & Clarke, 2006). The validation of the different interview coding systems was based on the approach suggested by Campbell and colleagues (2013), because it focuses specifically on in-depth structured interviews and, also, is particularly useful where coding of the transcripts is applied by a single knowledgeable coder.

The post-intervention quantitative survey data were analysed through the analytical software IBM® SPSS® Statistics 27 (IBM, Armonk, NY, USA). Aligned with the research questions, the analysis focused mostly on the descriptive statistics of the key variables (e.g. participants' evaluations of various aspects of the programme, use of implementation strategies, etc.) and group comparisons (e.g. intervention vs BAU control schools) where applicable.

Table 4: IPE methods overview

Data collection method	Data analysis method	Participant groups	Target number of participants (per case)	Total number of participants	RQs addressed
Semi-structured interview	Qualitative analysis	Headteacher (or deputy)	1	7	7–11
Semi-structured interview	Qualitative analysis	VC	1	6	7–11
Post-intervention survey	Descriptive statistics and qualitative analysis	VC	50	36	7–11
Post-intervention survey	Descriptive statistics and qualitative analysis	Teachers	98	91	7–11
Post-intervention survey	Descriptive statistics and qualitative analysis	Parents		13 intervention, 13 BAU control	9
Semi-structured interview	Qualitative analysis	Community optician	2	2	10, 11
Semi-structured interview	Qualitative analysis	Delivery team	1	1	10, 11

BAU, business as usual; IPE, implementation and process evaluation; RQs, research questions; VC, vision coordinator.

Costs

Cost data was collected directly from the developer as part of the developer interview within the IPE.

- the average cost per child for the school glasses (GiC);
- the average cost per child for breakages and/or loss of the school glasses;
- the number of contacts by the health team liaising (phone or visit) with the VC in addition to the planned monthly feedback; and
- the number of contacts the VC for each school had with parents to follow-up about glasses wear.

The EEF (2019) guidance on cost evaluation was used to determine the cost per pupil per year over 3 years.

Timeline

Table 5: Timeline

Dates	Activity	Staff responsible/leading
November 2018 – April 2019	Evaluation set up completed, recruitment material finalised, ethics submitted	UoN/UoL/BIHR
April 2019 – June 2019	School recruitment, expression of interest and Memorandum of Understandings received	UoL/BIHR
July 2019 – August 2019	Trial protocol, agreement, and trial registration completed	UoN
September 2019	Pupil withdrawal notifications received	UoL/BIHR
October 2019	Pupil data collected from settings and visual acuity and academic baseline testing completed	UoN/UoL/BIHR
October 2019 – November 2019	Randomisation completed	UoN
October 2019 – November 2019	Letters distributed to parents for eye appointments where appropriate, and glasses ordered	UoN/UoL/BIHR
December 2019 – January 2020	Glasses delivered to schools, school monitoring of eye glass wear	UoL/BIHR
March 2020	National lockdown	
September 2020 – January 2021	Retesting of treatment group, new glasses issued	UoL/BIHR
January 2021 – March 2021	National lockdown	
March 2021 – April 2021	Retesting of treatment group, new glasses issued	UoL/BIHR
March 2021 – May 2021	IPE surveys distributed and case studies conducted	UoN
May 2021 – June 2021	Pupil visual acuity and academic post-testing completed	UoN
May 2022	Submission of draft report to the EEF	UoN
May 2022 – July 2022	Submission of final edited report to the EEF, submission of data to the EEF archive and updating of ISRCTN trial registry with results	UoN

BIHR, Bradford Institute for Health Research; EEF, Education Endowment Foundation; IPE, implementation and process evaluation; ISRCTN, International Standard Randomised Control Trial Number; UoL, University of Leeds; UoN, University of Norwich.

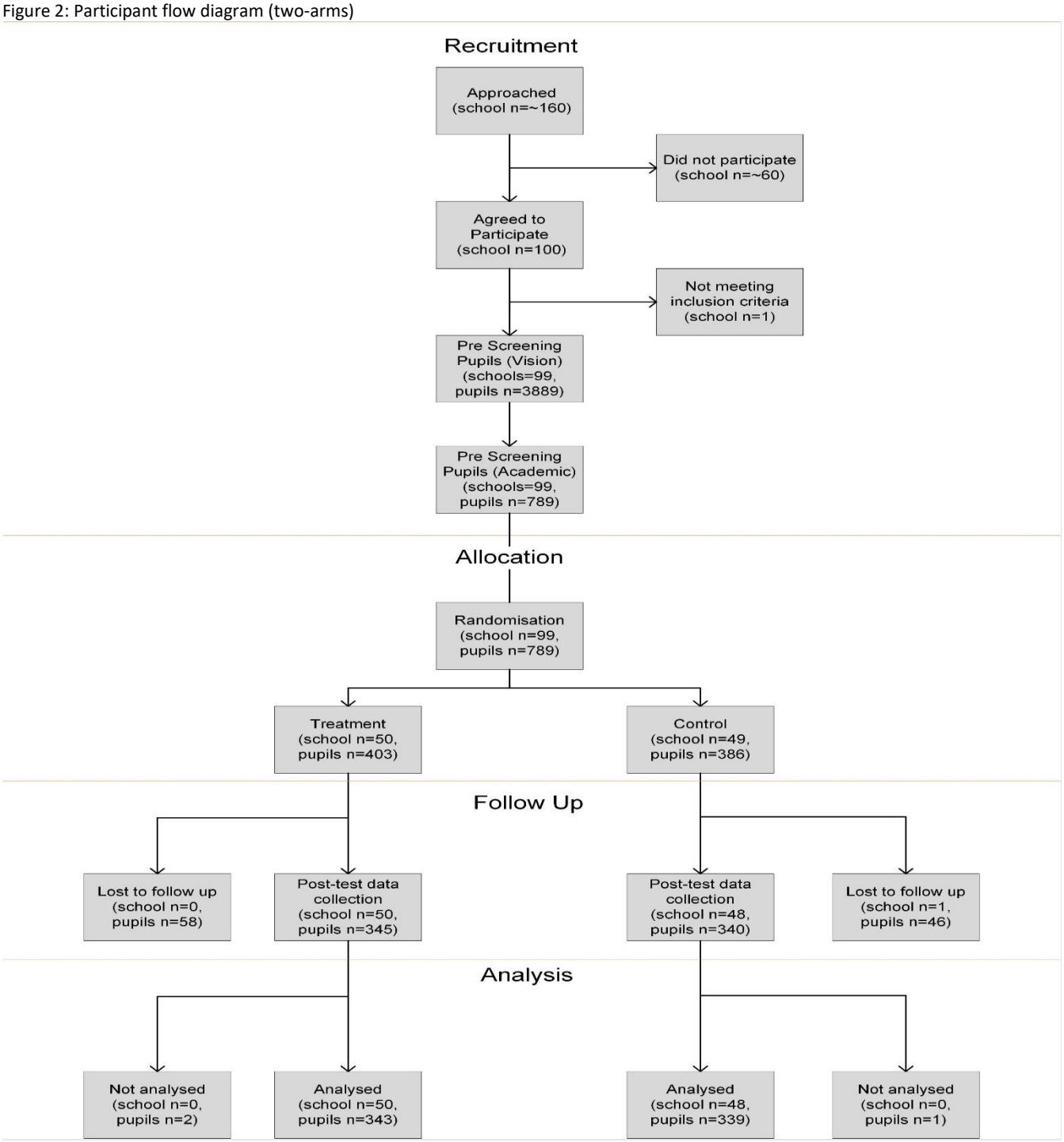
Results

Impact evaluation

The following section discusses participant (pupil and school) flow throughout the trial including those lost to the intervention and those who were excluded at various points in the analysis; the minimum detectable effect size (MDES) for the given sample size based on key characteristics of the trial at all stages; pupil-level attrition; and baseline characteristics of pupils and schools. Lastly the outcome analysis across the primary outcome and secondary outcomes measures.

Participant flow including losses and exclusions

Figure 2: Participant flow diagram (two-arms)



Recruitment benefited from the long-term relationship the developers had through the Born in Bradford longitudinal research programme with schools in the area, with approximately 160 schools approached during the recruitment phase. In total, 100 schools went forward to randomisation, although one was excluded before randomisation and notification, due to it being an independent school. Ultimately, 50 schools were randomised to the treatment condition and 49 schools to the BAU control condition. In the treatment arm, 403 pupils were identified to be >0.2 on the logMAR scale, and 386 pupils in the BAU control group. Post-test data was collected from 98 schools, with a further school lost to follow-up in the BAU control group comprising of 2 pupils, and a further 58 pupils in the intervention group and 44 in the BAU control group. Attrition will be discussed below in the next section.

Table 6 presents the MDES at all stages of the trial. The MDES was calculated in *R,* using the package *PowerUpR* (Bulus, Dong, Kelcey, & Spybrook, 2018) at the protocol, randomisation, and outcome analysis stage. The evaluation employed a two-level cluster randomised design with pupil-level outcomes. Pupils were nested in schools, with the GiC treatment administered at the school level for children in Reception year (which carried on with the same pupils into Year 1). At the design stage, we assumed 7 pupils per school within 100 participating schools, with the probability of being assigned to the treatment condition being 0.5. Interclass correlation was assumed to be 0.15 at the school level. This produced an MDES of 0.195 for the entire sample and 0.22 for the FSM subgroup analysis. Updated after the pupils and schools were recruited, the figures show that the MDES of 0.195 and 0.22 for the main and FSM subgroup analyses were achievable. At the point of analysis in January 2022, the updated pre–post correlations, ICC, and number of respondents at the pupil level and school level, provide the figures outlined in Table 6. The achievable MDES was 0.23 for the main effect and 0.39 for the FSM subgroup. In particular, the FSM subgroup MDES was larger than expected as only 75 schools had FSM-eligible pupils by the time of matching to DfE records, and the pre–post correlations were weaker than expected.

Table 6: MDES at different stages

		Protocol		Randomisation		Analysis	
		Overall	FSM	Overall	FSM	Overall	FSM
MDES		0.195	0.22	0.195	0.22	0.23	0.39
Pre-test/ post-test correlations	Level 1 (pupil)	0.88[8]	0.88	0.88	0.88	0.54	0.52
	Level 2 (school)	0.62	0.62	0.62	0.62	0.51	0.30
ICCs	Level 2 (school)	0.15[9]	0.15	0.15	0.15	0.10	0.05[10]
Alpha		0.05	0.05	0.05	0.05	0.05	0.05
Power		0.8	0.8	0.8	0.8	0.8	0.8
One-sided or two-sided?		Two-sided	Two-sided	Two-sided	Two-sided	Two-sided	Two-sided
Average cluster size		7[11]	3	8	3.4	7	2.5

[8] Villareal (2015) undertook a test review of the Woodcock-Johnson IV standard battery of tests and found correlations in the range of .83–.95. In the Woodcock-Johnson IV manual, test-retest correlations were between 0.83–0.95 for the age 7–11 group (p. 94). However, these sort of test-retest reliability analyses tends to be over very short periods (e.g. 1 day).
[9] We have selected an ICC of 0.15 as this represents a trade-off in that the schools are centred on a specific small geographical region, but on the other hand recognises that some of the EEF trials among early years have been higher at 0.17–0.19.
[10] This may be due to the very small average cluster size for FSM.
[11] Around 15% of the average primary school year group of 47. We estimate that around a third of the pupils will be on FSM (DfE, 2019).

Number of schools	Intervention	50	50	50	50	50	36
	Control (BAU)	50	50	49	49	48	39
	Total	100	100	99	99	98	75
Number of pupils	Intervention	350	150	403	173	343	97
	Control (BAU)	350	150	386	165	339	88
	Total	700	300	789	338	682	185

BAU, business as usual; FSM, Free School Meals; ICCs, intracluster correlation coefficients; MDES, minimum detectable effect size.

Attrition

As set out in Table 7, a total of 789 pupils in 99 schools were randomised, with 403 being assigned to the treatment group and 386 assigned to the BAU control group. One BAU control school consisting of two pupils was unable to accommodate the testing team due to concerns over COVID-related health and safety. The remainder of pupils lost were due to COVID isolation rules, movements between schools as families moved home, and families stuck abroad due to changing travel rules. There was a minor differential between the treatment group and the BAU control group with a total percentage attrition rate of 13.6%.

Table 7: Pupil-level attrition from the trial (primary outcome)

		Intervention	Control (BAU)	Total
Number of pupils	Randomised	403	386	789
	Analysed	343	339	682
Pupil attrition (from randomisation to analysis)	Number	60	47	107
	Percentage	14.8%	12.2%	13.6%

BAU, business as usual.

Pupil and school characteristics

Table 8 provides a summary of the baseline characteristics for all schools randomised, and those pupils who have been matched by the DfE NPD team. At the pupil level, participants have been compared on FSM for their first 2 years of schooling, gender, and one primary outcome (Letter-Word Identification), along with two academic secondary outcomes (Word Attack and Applied Problems), and two health outcomes (the logMAR scores for the worst and best eye). Schools have been compared on the basis of the Office for Standards in Education (Ofsted) ratings as of July 2019, urban and rural classification, percentage of FSM6 pupils, percentage of EAL pupils, Key Stage 1 average points score, Key Stage 2 mathematics average score, and Key Stage 2 reading average score.

At the pupil level, equivalence was good, particularly on the Letter-Word Identification scale primary outcome with an imbalance of -0.04 between treatment and BAU control on the effect size scale. The remaining pre-tests saw balances of -0.07 for Word Attack, and -0.02 for the Applied Problems scale. Balance for visual acuity was -0.04 for the left eye and -0.08 for the right eye. Through the creation of a worst and best eye measure, this changed to -0.10 for the worst eye, and -0.05 for the best eye. Approximately, 28% of pupils were FSM eligible at any point in the 2 years of trial (29.8% in the treatment and 27% in the BAU control). There was good representation of male and female pupils in the trial with 51% of the intervention group and 55% of the BAU control group being female. Pupils were extremely ethnically diverse,

with 71% of pupils of Black, Asian, and Minority Ethnic (BAME) backgrounds in the intervention group and 65% in the BAU control group.

At the school level, the intervention group and BAU control group are very similarly distributed in terms of Ofsted rating, as well as urban/rural classification, with most schools being in urban areas. Schools in the treatment group and BAU control group were close to the national average for FSM with the treatment schools having an average of 30.22% and the BAU control schools having an average of 29.12% (Table 8). The number of EAL pupils was substantially higher, with 42.78% pupils in the treatment schools and 37.04% pupils in the BAU control schools being classified as EAL (Table 8). There was a larger imbalance on the Key Stage 1 average point score between the treatment group and BAU control group, but very good balance on the Key Stage 2 mathematics and Key Stage 2 reading scores.

Table 8: Baseline characteristics of groups as randomised

School level (categorical)	Intervention group		Control (BAU) group		
	n/N (missing)	Count (%)	n/N (missing)	Count (%)	
Ofsted (as of July 2019)	50/50 (0)	6 Outstanding 32 Good 12 Requires improvement/ inadequate	49/49 (0)	5 Outstanding 32 Good 12 Requires improvement/ inadequate	
Urban vs rural	50/50 (0)	49 (98%) 1 (2%) rural	49/49 (0)	45 (92%) urban 4 (8%) rural	
School level (continuous)	n/N (missing)	Mean (SD)	n/N (missing)	Mean (SD)	
School percentage of FSM6 pupils (as measured at randomisation – 2019)	50/50 (0)	30.22 (13.89)	49/49 (0)	29.12 (14.44)	
School percentage of EAL pupils (as measured at randomisation – 2019)	50/50 (0)	42.78 (31.15)	47/49 (2)	37.04 (32.85)	
KS1 average points score	48/50 (2)	15.38 (1.16)	45/49 (4)	15.64 (1.15)	
KS2 mathematics average score	48/50 (2)	104.60 (2.45)	45/49 (4)	104.64 (2.02)	
KS2 reading average score	48/50 (2)	103.44 (3.13)	45/49 (4)	103.29 (2.22)	
Pupil level (categorical)	n/N (missing)	Count (%)	n/N (missing)	Count (%)	
FSM (for first 2 years of schooling)	377/382 (5)	114 (29.8)	375/382 (7)	103 (27.0%)	
Gender	382/382 (0)	196 (51% female)	382/382 (0)	210 (55% female)	
Pupil level (continuous)	n/N (missing)	Mean (SD)	n/N (missing)	Mean (SD)	Effect size
Letter-Word Identification pre-test	382/382 (0)	82.29 (14.47)	382/382 (0)	82.91 (15.06)	-0.04
Word Attack pre-test	382/382 (0)	85.70 (17.76)	382/382 (0)	87.01 (18.93)	-0.07
Applied Problems pre-test	382/382 (0)	88.90 (15.84)	381/382 (0)	89.26 (16.33)	-0.02

Visual acuity logMAR left eye pre-test	371/382 (11)	0.37 (0.16)	371/382 (11)	0.38 (0.17)	-0.04
Visual acuity logMAR right eye pre-test	374/382 (8)	0.35 (0.16)	372/382 (10)	0.36 (0.18)	-0.08
Visual acuity logMAR worst eye pre-test	371/382 (11)	0.42 (0.16)	371/382 (11)	0.43 (0.17)	-0.10
Visual acuity logMAR best eye pre-test	371/382 (11)	0.30 (0.13)	371/382 (11)	0.31 (0.15)	-0.05

BAU, business as usual; EAL, English as an Additional Language; FSM, Free School Meals; KS, Key Stage; logMAR, Logarithm of the Minimum Angle of Resolution; Ofsted, Office for Standards in Education; SD, standard deviation.

Outcomes and analysis

Primary analysis

The primary analysis of the impact of the GiC intervention as set out above was assessed in relation to a BAU control arm, on the basis of intention-to-treat, using a two-level multi-level linear model estimated by Bayesian inference. The primary outcome of interest was the average difference in the standardised Letter-Word Identification subscale score between the GiC treatment group and the BAU control group. The distribution of the pre- and post-test for Letter-Word Identification are presented in Figure 3 below.

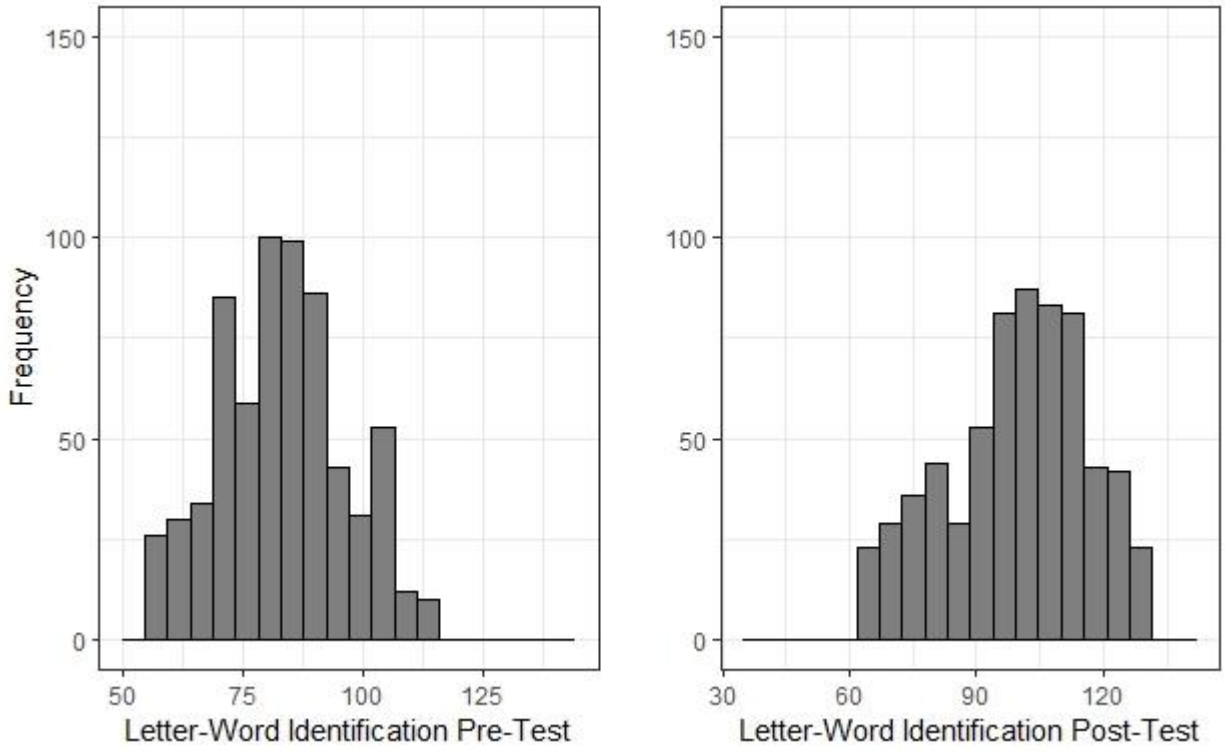


Figure 3: Distributions of the pre- and post-test for the Woodcock-Johnson IV Letter-Word Identification subscale

Table 9: Primary outcome analysis

	Unadjusted means (analytical sample)				Model-based inference		
	Intervention group		Control (BAU) group				
Outcome	n	Mean (SD)	n	Mean (SD)	Total n	Hedges' g (95% CI)	ROPE (-0.1, 0.1 ES)

Primary Outcome: Letter-Word Identification	343	98.16 (18.73)	339	99.8 (18.45)	682	-0.03 (-0.16, 0.10)	86.35 %

BAU, business as usual, CI, credible interval; ES, effect size; ROPE, Region of Practical Equivalence; SD, standard deviation.

Table 9 presents the unadjusted means of the intervention group and BAU control group on the left-hand side for the analytical sample, and on the right-hand side the model-based inference controlling for the pre-test score. On the basis of the available evidence, there is no clear effect for the intervention group with the effect being -0.03 (-0.16, 0.10). The ROPE suggested that majority of the posterior distribution fell between -0.1 and 0.1 on the effect size scale, again indicating no evidence of a practical difference from 0.

Secondary analysis

The secondary analyses, as with the primary analysis discussed above, were assessed against the BAU control arm, on the basis of intention-to-treat using a multi-level linear model estimated by Bayesian inference. Below present the distributions for Word Attack (Figure 4) and Applied Problems (Figure 5).

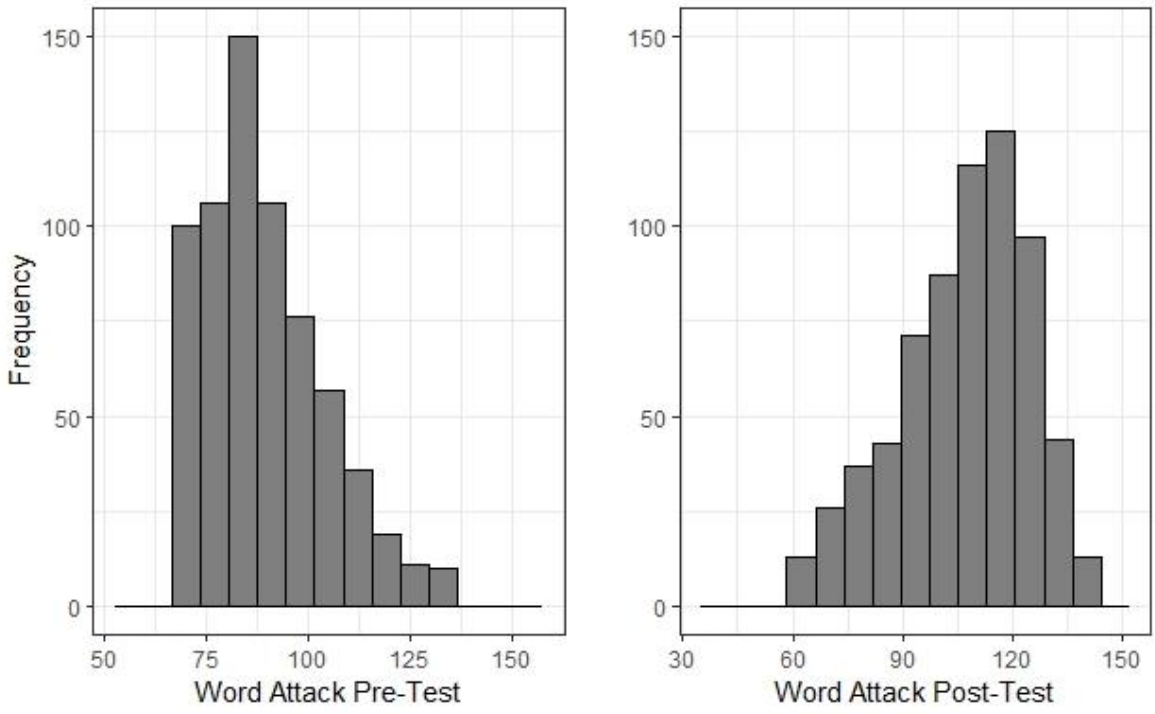


Figure 4: Distributions of the pre and post-test for the Woodcock-Johnson IV Word Attack Identification subscale

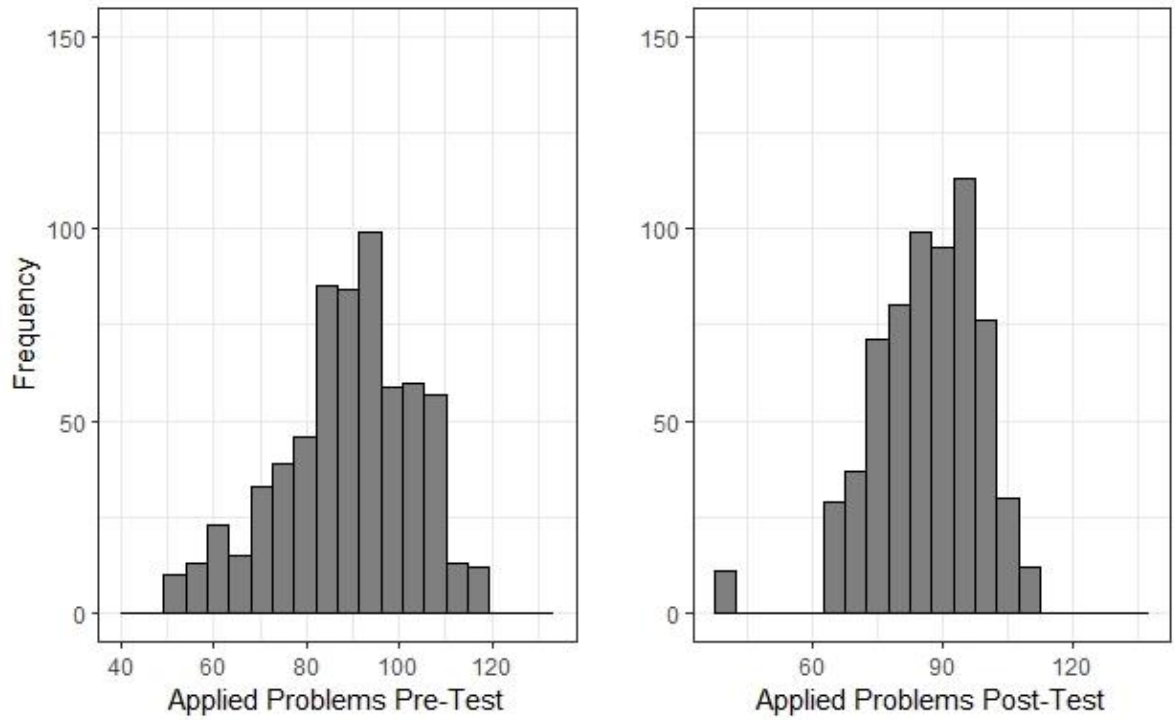


Figure 5: Distributions of the pre and post-test for the Woodcock-Johnson IV Applied Problems subscale

The distributions for visual acuity are presented in Figure 6. These have been presented as 'best eye' and 'worst eye' for the pre- and post-test. Note that improvements in visual acuity are represented by a lower logMAR score. The pre-trial cut-off of 0.2 logMAR is illustrated by the dashed red line in the plots below.

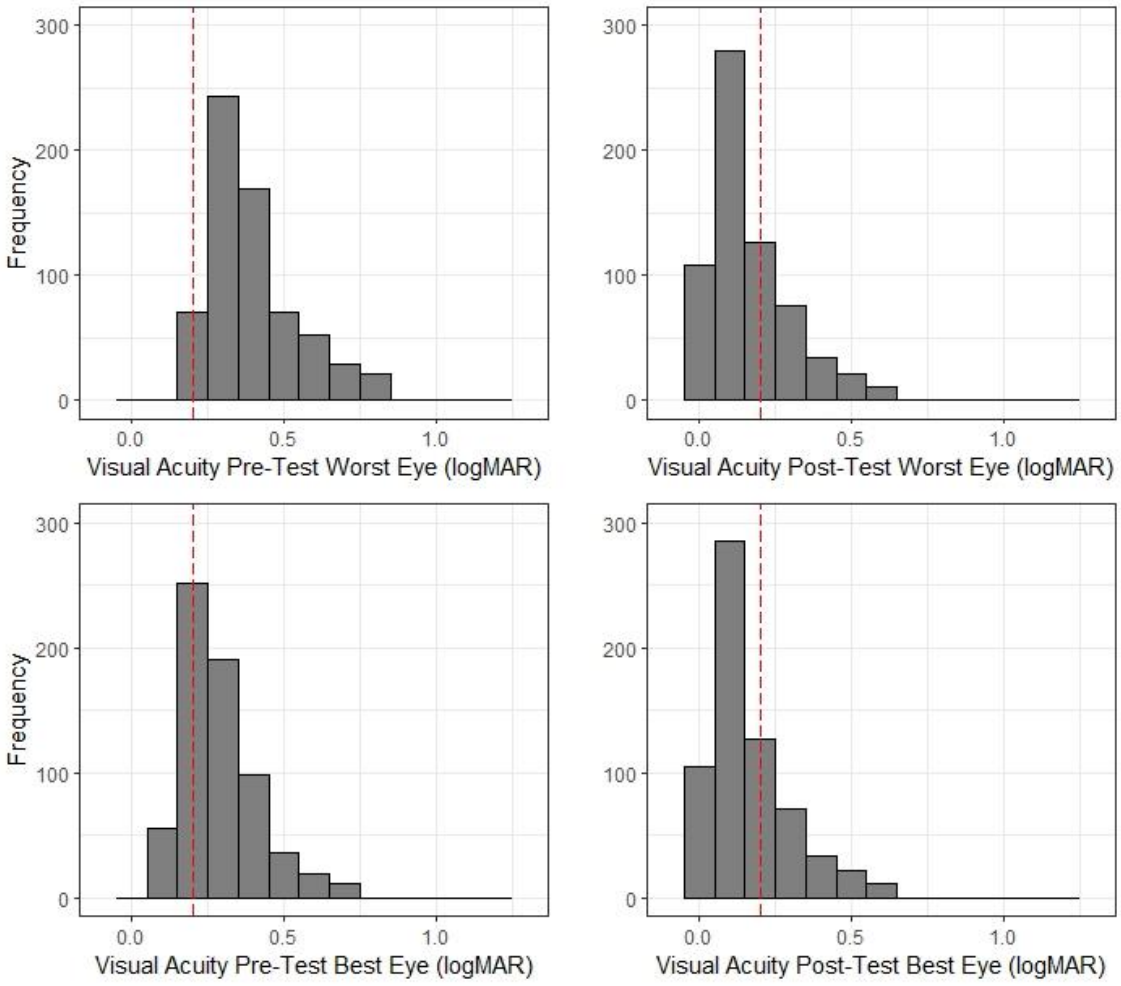


Figure 6: Distributions of the pre and post-test for the visual acuity logMAR. logMAR, Logarithm of the Minimum Angle of Resolution

As reported in Table 10 and as shown by the reported Hedges' g parameter estimates, all of the outcomes crossed 0, demonstrating that there is no clear evidence with the existing data of an effect of the GiC intervention.[12]

Table 10: Secondary outcome analysis

	Unadjusted means (analytical sample)					Model-based inference	
	Intervention group		Control (BAU) group				
Outcome	n	Mean (SD)	n	Mean (SD)	Total n	Hedges' g (95% CI)	ROPE (-0.1, 0.1 ES)
Secondary outcome: Word Attack	343	84.99 (14.07)	339	86.99 (13.95)	682	0.06 (-0.18, 0.07)	78.16%
Secondary outcome: Applied Problems	343	104.85 (20.04)	339	106.37 (17.89)	682	-0.04 (-0.20, 0.11)	77.24 %
Secondary outcome: visual acuity (worst eye)	342	0.17 (0.14)	339	0.18 (0.16)	681	-0.06 (-0.21, 0.09)	72.90%
Secondary outcome: visual acuity (best eye)	342	0.17 (0.14)	339	0.17 (0.16)	681	-0.04 (-0.19, 0.11)	77.87%

BAU, business as usual; CI, credible interval; ES, effect size; ROPE, Region of Practical Equivalence; SD, standard deviation.

Subgroup analyses

FSM was not powered to detect a small effect size from the design stage, and as with the primary and secondary analyses, all modelled effects for FSM presented in Table 11 crossed the 0 boundary, meaning that the trial did not provide clear evidence of an effect of the GiC intervention against the BAU control. However, there were two interesting results, which are potentially worthy of further consideration, albeit with considerable caution as the evidence remains weak. Among FSM pupils, the primary outcome of the Letter-Word Identification subscale had an effect size of 0.09, and while the credible interval stretched from -0.12, 0.30, but as shown in

Table 13, the probability of direction statistic suggests that 79% of the posterior distribution was positive, indicating weak evidence of a treatment effect. For the worst eye and best eye, there were effect sizes of -0.13 (with a credible interval of -0.44, 0.16) and -0.08 (with a credible interval of -0.37, 0.21), respectively indicating lower logMAR scores (better visual acuity) after controlling for pre-intervention visual acuity for the treatment arm versus the BAU control arm. The probability of direction statistic indicated that 81% and 70%, respectively of the posterior distribution was in the same negative direction of the reported effect. The probability of direction statistic provides a proportion of the posterior distribution, which falls in the direction of the mean effect. This again indicates weak evidence of a treatment effect.

Table 11: FSM subgroup outcome analysis

	Unadjusted means (analytical sample)	Model-based inference

[12] Interestingly, the majority of the posterior distribution on the visual acuity measure for the worst eye and best eye was negative (i.e. showing that the treatment arm had on average lower levels of poor visual acuity compared to the BAU control group after controlling for pre-intervention visual acuity). The ROPE statistic suggests that approximately 73% and 78% of the effect is within -0.1, 0.1 boundary, so it is a very small effect.

	Intervention group		Control (BAU) group				
Outcome	n	Mean (SD)	n	Mean (SD)	Total n	Hedges' g (95% CI)	ROPE (-0.1, 0.1 ES)
Primary outcome: Letter-Word Identification	97	94.94 (20.08)	88	91.75 (18.88)	185	0.09 (-0.12, 0.30)	53.09 %
Secondary outcome: Word Attack	97	82.97 (14.34)	88	84.36 (14.55)	185	-0.01 (-0.20, 0.19)	71.22 %
Secondary outcome: Applied Problems	97	100.33 (21.54)	88	100.64 (18.87)	185	0.00 (-0.22, 0.23)	64.48 %
Secondary outcome: visual acuity (worst eye) FSM sample	97	0.17 (0.13)	88	0.19 (0.15)	185	-0.13 (-0.44, 0.16)	39.86%
Secondary outcome: visual acuity (best eye) FSM sample	97	0.17 (0.13)	88	0.18 (0.15)	185	-0.08 (-0.37, 0.21)	45.80%

BAU, business as usual; CI, credible interval; ES, effect size; FSM, Free School Meals; ROPE, Region of Practical Equivalence; SD, standard deviation.

Analysis in the presence of non-compliance

Evidence of compliance and fidelity to the intervention was very mixed. On Key Component 1, the Professional Development Indicator, each intervention school's VCs attended the training in year 1 of the study, and the retraining in year 2 of the study, although there was significant movement of staff within primary schools and transfer of roles during each academic year, and some coordinators did not get retrained or avail of sufficient instruction during the handover of roles within the schools themselves.

On Key Component 2, the Pupil Optometrist Attendance Indicator (attendance at an optometrist with a prescription), only 69.2% of pupils in the treatment group attended, compared with 68.4% in the BAU control group in year 1 of the study. Around 2.7% of pupils in the treatment group did not attend (compared to 2.3% in the BAU control group), and the remainder we have no data for; 28.1% in the treatment group and 29.3% in the BAU control group. Averaged across all treatment schools, majority of schools scored a 0, with only 19 meeting the requirement of 80% of pupils attending the community optometry appointments, and of that only 13 meeting the requirement of 90–100% attending an optometrist. As a comparison, 19 schools in the BAU control group had >=80% of their pupils attending an optometry appointment.

In year 2 of the study, with in-school testing and dispensing, the number of pupils in the treatment group 'attending' a school appointment increased to 90.7%. Testing started on 5th November 2020 and was completed by 11th May 2021, with 176 pupils tested before January 2021 lockdown and 184 tested from March 2021 onwards. The average number of workdays taken to conduct the updated eye tests (refraction) from the start of the 2020/2021 academic year was 110 days. A remaining of 9.3% did not attend for a number of reasons, but mostly surrounding COVID-19 social isolation rules, wider issues of absence, or having left the school. Within the BAU control group, the data returns were poor and only 10.1% were recorded as having attended, with 89.9% of data missing for the remaining pupils.

On Key Component 3, the Materials Indicator, the health Materials Indicator measuring the percentage of pupils in receipt of two pairs of personal glasses was significantly impacted on the missingness detailed for Key Component 2. For year 1 of the study, 54.6% of pupils in the treatment group received two pairs of glasses, compared to 53.9% of pupils in the BAU control group receiving one pair of glasses. In year 2 of the study, within the treatment group, 5.1% of pupils received no new glasses as their prescription had not changed, 7.6% received one replacement pair, 63.1% received two new pairs, and finally 14.9% of pupils had a change in their prescription and improvement in their visual acuity enough to end the use of glasses. The remainder are made up of those pupils who were not reached due to the reasons outlined above, and mostly surrounding the impact of COVID-19 restrictions on attendance.

Missing data analysis

We constructed a dropout model of missingness for the primary outcome of Letter-Word Identification and we coded those missing the outcome a value of 1 with the remaining completely observed cases coded with a 0. This missingness indicator was then specified as the outcome in a multi-level logistic regression model, with treatment condition, pre-test, gender, and FSM. The base-case was a pupil in the BAU control group, female, non-FSM, and with an average pre-test Letter-Word Identification pre-test score. Males were just under two times more likely and those who were FSM were just over two times more likely to have missing post-test data.

As discussed in the Methods section, we ran a two-level imputation model for 5,000,000 iterations and generated four imputed datasets. We then fitted the primary model to each of the imputed datasets and merged the posterior samples, generating summary statistics. We found that the effect size remained consistent with the complete case analysis results with a mean effect size of -0.04 (-0.10, 0.13). The ROPE statistic indicated majority of the posterior distribution fell in the region very close to 0 and the probability of direction was 0.71 negative.

Table 12: Missing data imputation primary outcome analysis

	$Mean\ (\theta)$	θ l-95% CI	θ u-95% CI	Probability of direction (maximum probability of effect)	ROPE (-0.1, 0.1 ES)
Letter-Word Identification	-0.04	-0.19	0.11	0.68	79.63%

CI, credible interval; ES, effect size; ROPE, Region of Practical Equivalence.

Additional analyses and robustness checks

As there was no significant effect on either the Woodcock-Johnson IV or the visual acuity measures we did not conduct any mediation analysis. We did carry out robustness checks using maximum likelihood estimation procedures, as well as modelling the primary model with mean-centred school-level averages for the pre-test score. These remained consistent with the results reported above.

On the issue of dosage, and glasses wear in treatment schools, due to the impact of disruptions due to COVID-19 we only have data for the updated dispensing of glasses to pupils in the treatment during the 2020/2021 academic year for 263 pupils, rather than for the initial period of the Spring Term 2020. The mean days with glasses was 101 with a SD of 56 days. Around 133 pupils had their glasses for less than 3 months and of those, 17 for less than 1 month prior to testing. The distribution of days with the updated pairs of glasses is presented below in Figure 7. Despite the best efforts of the developer team, there were considerable unexpected delays in testing and dispensing glasses after schools reopened in March 2021 due to ongoing health and safety concerns surrounding testing teams entering schools to carry out this work. In total, 34 out of the 50 schools returned glasses tracker data with home glasses being worn at school 62.5% of the time for the recorded periods available (a.m. and p.m. sessions) indicating the importance of the availability of the school pair.

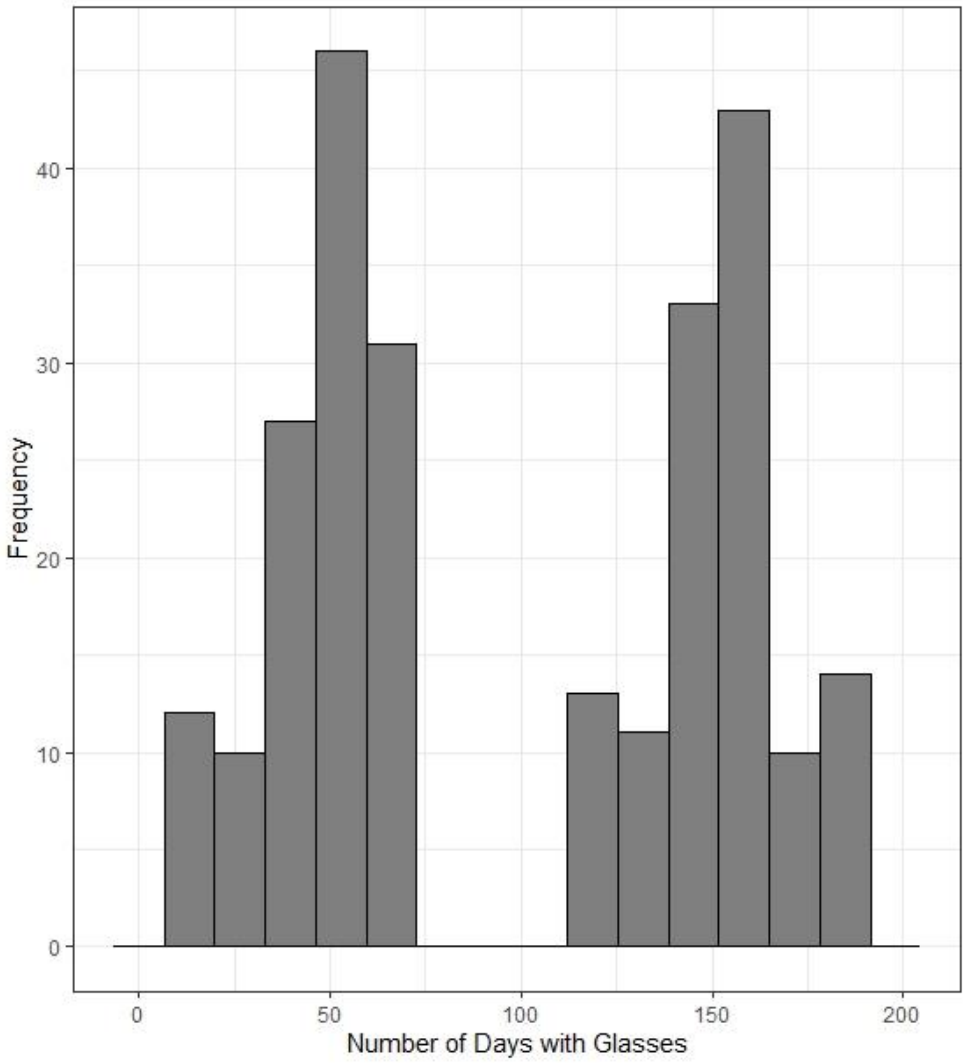


Figure 7: Distribution of the number of days in year 2 of the trial in which pupils had their updated home and/or school pairs of glasses. Note: the gap at around 100 days can be explained by the January 2021 lockdown

Estimation of effect sizes

As discussed above, effect sizes have been calculated using Hedges' g. These have been reported in Table 9 to

Table 12 above, and are further summarised in
Table 13 below.

Table 13: Effect sizes with Bayesian probability of direction, and ROPE statistics

Outcome	Mean effect	95% lower CI	95% upper CI	Probability of direction (maximum probability of effect)	ROPE (-0.1, 0.1 ES)
Letter-Word Identification: full analytical sample	-0.03	-0.16	0.10	0.67	86.71%

Letter-Word Identification: FSM sample (interaction effect)	0.09	-0.12	0.30	0.79	53.09%
Word Attack: full analytical sample	-0.06	-0.18	0.07	0.81	78.3%
Word Attack: FSM sample (interaction effect)	-0.01	-0.20	0.19	0.53	71.22%
Applied Problems: full analytical sample	-0.04	-0.19	0.10	0.71	80.08%
Applied Problems: FSM sample (interaction effect)	0.00	-0.22	0.23	0.50	64.48 %
Visual acuity: full analytical sample, worst eye	-0.06	-0.21	0.09	0.77	72.90%
Visual acuity: FSM sample (interaction effect), worst eye	-0.13	-0.44	0.16	0.81	39.86%
Visual acuity: full analytical sample, best eye	-0.04	-0.19	0.11	0.72	77.87%
Visual acuity: FSM sample, best eye	-0.08	-0.37	0.21	0.70	45.80%

CI, credible interval; ES, effect size; FSM, Free School Meals; ROPE, Region of Practical Equivalence.

Estimation of ICC

Table 14: ICC analysis

Outcome	ICC
Letter-Word Identification: full analytical sample (post-test)	0.10
Letter-Word Identification: full analytical sample (pre-test)	0.09
Letter-Word Identification: FSM sample (post-test)	0.05
Letter-Word Identification: FSM sample (pre-test)	0.12
Word Attack: full analytical sample (post-test)	0.10
Word Attack: full analytical sample (pre-test)	0.14
Word Attack: FSM sample (post-test)	0.11
Word Attack: FSM sample (pre-test)	0.22
Applied Problems: full analytical sample (post-test)	0.09
Applied Problems: full analytical sample (pre-test)	0.03
Applied Problems: FSM sample (post-test)	0.04
Applied Problems: FSM sample (pre-test)	0.14
Visual acuity: full analytical sample (worst eye post-test)	0.01
Visual acuity: full analytical sample (worst eye pre-test)	0.01
Visual acuity: FSM sample (worst eye post-test)	0.05
Visual acuity: FSM sample (worst eye pre-test)	0.06

FSM, Free School Meals; ICC, intracluster correlation coefficient.

As part of the early modelling in the analysis, 16 variance component model analyses were carried out to estimate the ICC at the school cluster level. This was to provide further data for the MDES calculations in above, and as further information for future research projects. ICC refers to the relatedness of responses within the school cluster. In the design and randomisation power analyses, we were very cautious around the proposed ICC, choosing a value of 0.15 or 15% of the variance at the school level. At the analysis stage, we found that the ICCs were smaller than expected across all measures.

IPE

Summary

- Variations in the numbers of children, rate of staff turnover, main and changing roles of the VC, relationships from: a) school to system level; and b) school to home, are all aspects of the context that affected the readiness of schools to make the most of the intervention.
- The training of VCs therefore needs to be further developed to take account of the challenges presented by different contexts and by different role-holders; one size does not fit all.
- There was widespread support for the programme (98% teachers), recognition of the quality of the design, and the usefulness of the training.
- Nearly all intervention schools want to remain involved in the programme and would recommend it to other schools (97% of teachers).
- Most VCs (80%) reported children's improved focus on learning; half reported improved academic performance; around one-third reported improved well-being.
- The COVID-19 pandemic impacted various aspects of the intervention (and evaluation) despite the best efforts of all concerned to mitigate the impact.
- Other barriers to implementation included: 1) loss and/or breakage of glasses; and 2) ensuring parental engagement/support.
- Although VCs found it difficult to communicate with parents given the pandemic, they reported parents' improved awareness of the importance of, and support for, glasses use.
- The location and process for eye testing (refraction), and dispensing could be redesigned to maximise parental engagement and subsequent glasses use.

The IPE is organised by first presenting six case study vignettes. Evidence from these cases is then triangulated to the wider evidence base under four themes:

- context and change;
- programme aims and implementation;
- implementation challenges; and
- perceptions of impact.

The themes answer (IPE) research questions presented in Table 15.

Table 15: Research questions

Main research questions	Secondary research questions
7. What **strategies** to teachers use to encourage the wearing of glasses, in (high/low fidelity) intervention and BAU control schools?	7.1. Overall, what factors have shaped the use of implementation strategies in schools? 7.2. Has the programme-related training in particular influenced strategy use, and if so, how? 7.3. What strategies were used to encourage and monitor glasses-wearing at school/home? 7.4. How did these strategies influence parents' and children's engagement with the programme? 7.5. Were there any group differences in strategy use between intervention and BAU control schools?
8. What **strategies** do VCs use to encourage wearing of glasses?	8.1. Overall, what factors have shaped the use of implementation strategies in intervention schools? 8.2. Has the programme-related training in particular influenced strategy use, and if so, how?

	8.3. What strategies were used to encourage and monitor glasses-wearing at school/home for children from intervention schools? 8.4. How did these strategies influence parents' and children's engagement with the programme?
9. How do headteachers, VCs, teachers, and parents perceive the **effectiveness** of GiC?	9.1. Overall, what is the perceived quality of the programme (its elements and the implementation process)? 9.2. What are the perceived benefits (for children and beyond) from the programme's implementation? 9.3. Should the programme be continued?
10. Are there any **unintended consequences** of GiC in the intervention group?	10.1. Were there any unexpected challenges, which may have influenced: i) the implementation process; and ii) its outcomes? 10.2. Were there any unintended consequences associated with the programme's original design/implementation process?
11. What types of **structures and partnerships** need to be in place to help deliver GiC to large numbers of schools at scale?	11.1. How efficient were the original programme networks (e.g. collaboration within the programme team, between the programme team and schools, etc)? 11.2. What structures and partnerships did work best/didn't work? 11.3. How can the programme (design and implementation process) be improved to cover larger numbers of schools?

Case studies

School 1 ('low fidelity'): Has a three-form entry with 731 pupils on roll, a small proportion of whom are White British children, and 19.7% are eligible for FSM. There is a designated specialist provision for pupils with Special Educational Needs (SEN). In total, 25 children participated in GiC. The VC is also the school's SEN and disabilities coordinator, with a limited capacity for direct observations of the children participating in GiC. Despite being primarily based in School 1 for about 5 years before the start of the GiC programme in 2019, the VC first worked as a VC for another non-case study school and about a year later left to take on the VC role for School 1 from the previous coordinator (a Reception year teacher). She did not communicate this change with the GiC project team. Reportedly, the communication between this VC and the project team was broken until the final stages of the programme's implementation in 2021, when it resumed. As part of the IPE, the VC and a representative of the school's SLT were interviewed in May 2021. Three parents submitted survey responses in June 2021 and July 2021. No survey responses were received for the VC and teacher surveys.

School 2 ('low fidelity'): Has 469 pupils, 28.2% of whom are eligible for FSM. Most pupils are of non-British (predominantly Pakistani) heritage. In total, 7 children participated in GiC. The VC is also the school's Nursery Nurse in Reception year and had a limited opportunity for observing the children involved in GiC, especially during the second year of the programme's implementation, due to other commitments. The project's records indicate almost non-existent communication with the VC, who consistently did not respond to project emails until early 2021. In May 2021, the VC and two representatives of the school's SLT were interviewed. It transpired that one of the senior leaders, involved in GiC, joined later after taking over from another colleague. The other senior leader admitted little involvement with the programme, due to other, pressing priorities. Both SLT members shared concerns about broken communication with the project team. In June 2021 and July 2021, survey responses were received from one teacher and two parents. No response from the VC was submitted through the online survey platform.

School 3 ('low fidelity'): Has 683 pupils, which (according to the DfE's records available online) is above the school's capacity of 650. The school's catchment area is diverse, with a mixture of ethnicities and classes. The number of parents renting accommodation has increased more recently, and 32.9% of the pupils are eligible for FSM. The pupils in nursery/Reception and those in Years 1 to 6 are separated into two buildings (one on each side of a road). In total, 14 children participated in GiC. The VC's main role is Reception year teacher and phonics lead. After the first year of the GiC programme, she had very limited contact with the participating children. The project records reveal a lack of communication from the VC to the project team until May 2021, as well as very little compliance data provided by the school. The VC and an SLT member were interviewed in May 2021. Admittedly, the SLT member had little involvement in the implementation of GiC. No responses to the three surveys (teacher, VC, parent) were submitted from this school.

School 4 ('high fidelity'): Operates in a rural, heritage area, with predominantly White British population. Currently, it has 328 pupils, 12.7% of whom are eligible for FSM. The school offers special provision for pupils with SEN. Three children participated in GiC. The VC is also a deputy headteacher and has been involved in GiC since the start of the programme. According to the project records, she demonstrated high levels of engagement and compliance throughout

the overall implementation process. The same person was interviewed as both the VC and an SLT member in May 2021 and shared that she would be leaving School 4 shortly. In June 2021, one teacher responded to the post-intervention survey. No survey responses from the VC and parents were received.

School 5 ('high fidelity'): Is a 'all-through' school to a senior (girls only) school. It has on roll 383 primary pupils (both boys and girls). Over 90% of the pupils are of Pakistani heritage, and 29% of them are EAL. Around 24% of pupils are eligible for FSM. In total, 15 children participated in GiC. The VC is also a Year 1 teacher, in frequent contact with GiC children during the second year of the programme's implementation. The VC, who joined the programme at a later stage (September 2020), is described in the project records as 'highly engaged and providing a good amount of compliance data'. In May 2021, at the interviews with the VC and an SLT member, it was revealed that the SLT member became involved in the GiC programme over a year after it was launched and had limited knowledge of it. One survey response from a teacher was submitted in June 2021. No survey responses from the VC and parents were received.

School 6 ('high fidelity'): Is currently providing for 475 pupils. Around 19% come from minority ethnic groups, and 14.6% are eligible for FSM. In total, seven children participated in GiC. The VC, who is also a Year 1 teacher, has been involved in the programme since the very beginning (2019). In the project records, her performance is described as 'consistently engaged and responsive throughout, providing an excellent amount of compliance data'. The VC and a member of the school's SLT were interviewed in May 2021. In June 2021 and July 2021, survey responses were received from the VC, a teacher, and a parent. This is the only case study school, which provided at least one response to each of the overall three post-intervention surveys.

Context and change

The GiC intervention took place in Bradford where existing programmes and relationships provided a strong foundation for implementation. This is important when considering the overall impact of the intervention and might need to be considered in planning a scale-up of the programme in the future. The IPE explains the importance of some of these background contextual factors. It also needs to be borne in mind that the primary schools landscape in which GiC was implemented has its own contours. Schools might be anything from single form entry to third form entry, with variability in need for glasses, involvement of parents, and experience/stability of staffing and leadership. This can mean more or less capacity to support innovation and the administrative requirements of an intervention.

The numbers of children participating in the GiC programme varied significantly across the case study schools. For instance, one VC coordinator ('high fidelity' school) reported working with three children, while another one ('low fidelity' school) was accountable for over 20 children. The higher number of participating children was considered challenging, especially when combined with other contextual characteristics, for example SEN provision.

The VCs came from a variety of school staff roles with different affordances and constraints. One VC was a deputy headteacher and a former headteacher, two were Year 1 teachers, one a Reception year teacher, one a nursery nurse, and one a SEN and disabilities coordinator. The deputy headteacher saw her leadership role as benefiting her VC role as it allowed her to engage with other senior leaders and influence staff involvement in the programme. The two Year 1 teachers appreciated the opportunity of having direct, frequent contact with the children participating in the programme. Despite the varying levels of access to participating children, all the case study VCs reported high levels of motivation to be involved and were seen by their senior leaders as contributing highly to the implementation process. However, in four of the six schools (three of which were 'low fidelity'), the VCs joined the programme later, replacing the originally appointed VCs. The most common reason was staff turnover, followed by a high workload, and in one case, staff promotion. Moreover, the change of the VCs in the four schools affected their participation in the programme-related training. While some VCs found the refresher training a good enough replacement of the original (initial) training, others expressed concerns.

A somewhat similar pattern occurred regarding the SLT members' involvement. Three case study schools reported some changes in the SLT staff since the start of the programme. Although generally supportive of their VC colleagues, some senior leaders admitted very little involvement in the programme. Most of the SLT members in the 'low fidelity' schools reported lower levels of involvement (compared to those from 'high fidelity' schools).

More generally, of the VC survey respondents (N=36), seven (19%) reported being the headteacher (or deputy), 10 (28%) described themselves as teachers without leadership responsibilities (eight were Year 1 teachers, one was a Reception year teacher, and one selected 'Other teacher'). An almost equal percentage of respondents (N=17, 47%)

were in non-teaching roles. These included several nursery nurses, SEN and disabilities coordinators, higher level TA (HLTA), a personal assistant to the headteacher, an office administrator, and a parental involvement worker.

When asked to rate the frequency of their observations of the GiC children on a scale from 1 (not at all) to 5 (nearly every day), just over half of the VC respondents (53%) reported frequent contact with the GiC children; 36% reported less frequent contact, and two said that they had no direct observations of the GiC children at all. In addition, just over 60% of the VCs had been involved in the GiC programme from the beginning, about 36% only joined in September 2020/October 2020, and one selected 'Other' but did not provide further explanation. Taken together, these data indicate that at least a third of the VCs became involved with the programme halfway through and/or had limited opportunity to directly observe the glasses-wearing at school. Such turnover is part of the context for any educational intervention, yet given the critical role of the VC, this is an important consideration in designing resilient scaled versions of the programme.

The developer explained that the purpose of the GiC programme is to support and strengthen the standard annual vision screening programme (SAVSP) by involving schools to engage with both parents and children. The GiC intervention contained two new elements: following vision screening at school; sharing the outcomes of the screening with the schools and providing glasses and monitoring glasses-wearing in school. Thus, key for the success of the GiC intervention was the effective network collaborations and the proactive role of the schools in ensuring high levels of parent and children engagement.

The role of the schools, VCs, and teachers in the programme is complex because it involves the (co-)organisation of the vision screening tests in schools, the use of various strategies for engaging with both parents and children, and monitoring of and reporting on glasses-wearing in schools. From the developer's perspective, although school involvement continued almost fully throughout the 2 years of implementation, the levels of engagement varied (sometimes significantly) across schools. These variations were also evident in the involvement of the VCs, whose contributions were of great importance for the programme's success. Reducing such variability will be important for any future scale-up.

In summary, variations in the numbers of children, rate of staff turnover, main role of the VC, relationships from school to system level and school to home, are all aspects of the context that effect the readiness of schools to make the most of the intervention.

Programme aims and implementation

Programme design

All case study interviewees expressed their appreciation of the programme's aims and overall quality. Some referred to the potential benefits of the programme for the children involved and called for its extension both in terms of its length and geographical scope. All said that they would like to remain involved in the programme in the future and would recommend it to colleagues in other schools. This positive view was endorsed more generally; 98% (N=89) of the 91 teachers surveyed considered the programme to be beneficial to their learners and 97% (N=88) of the 91 teachers thought it should be implemented widely in the future.

When asked to compare the GiC programme to the SAVSP, all VCs and SLT members spoke in favour of GiC. The GiC programme was particularly appreciated for its capability to provide: i) early and more regular screening checks; ii) feedback to schools about children's need of glasses; iii) additional pairs of glasses; iv) support for parents in monitoring glasses-wearing; and v) ultimately, providing more children with access to the support, which they need.

Interviewees praised the quality of the three aspects of the programme's design:

1. ***Training:*** The VCs' appreciation of the quality of and the benefits from the programme-related training echoed across all schools. VCs felt that the training was a key facilitator of their work on GiC not just in terms of raising their awareness of the specifics and importance of glasses-wearing and the implementation process, but also by equipping them with strategies for successful engagement with children and parents and allowing opportunities for sharing experience with other VCs. Half of the VCs attended both the initial training (in 2019) and the refresher training (in 2020), and some pointed out that the additional option to contact the programme team for further advice was helpful.

2. ***Networks and communication:*** This aspect of the programme's implementation refers to the key communications between the schools and the programme team (i.e. project partners and community optometrists). Most VCs felt supported by the programme team. However, there were some contrasting experiences of broken network communication that hindered the implementation of the programme. One VC struggled with the multiple contact points throughout the programme's implementation. Moreover, there were indications that the external service provided to the children may not be consistent. The SLT member in one of the schools felt that they were left out as although their VC was in regular contact with the programme team, no communication from the programme team was directed to them.

3. ***Support within/from the school:*** The interview data suggesting that there were two broad categories of school support, perceived as important for the programme's implementation. These refer to support for the VCs and support for the parents of the children involved in GiC. Most VCs felt supported by their leaders and colleagues. By some, GiC was also perceived in terms of additional support provided by the school to the parents.

VC role

The VC survey respondents (N=36) were asked to rate the importance of the VC role for the programme's implementation on a scale from 1 (not at all) to 5 (very important). In total, nearly 65% considered the role important or very important, while 17% thought the VC role to be of moderate or little importance. Although most of the VC survey respondents considered their role important for the programme's implementation, a relatively high number (almost a fifth) appeared to not attribute much significance to it. This might not be all it seems as there is a substantial overlap between teacher and VC roles (82% of teacher respondents were also VCs), and the scale of implementation across schools; 'coordination' demands vary.

Around 20 of the VCs (58%) thought that the GiC's implementation did not require much extra time and resources, seven (20%) did not provide a definitive answer, and eight (22%) disagreed and strongly disagreed. These data suggest that although most of the respondents found the programme relatively easy to implement and not overly resource consuming, but for others this might have not been the case. Here too this is associated with the scale of the coordination demand in schools.

VCs were asked if they had attended any of the programme-related training. Over half of survey respondents attended both the initial (in October 2019) and the refresher training (in September 2020), about 40% attended the training once (31% for the refresher training and 8% for the initial training), and two VCs (6%) did not attend any training at all. When asked whether they found the training helpful, most (78%) agreed and/or strongly agreed, about 17% did not commit to a definitive answer, and 6% disagreed. These clusters of data demonstrate an overall positive attitude to the programme-related training, but also some gaps in training attendance and usage.

Communication

VCs were asked about their communication with the community health team (orthoptists), which is a critical part of the intervention (see Key Component 1: sharing vision screening results). While nearly 70% agreed and strongly agreed that this communication was helpful, nearly 17% disagreed. VCs were invited to feedback on the support, which they received from their school. Again, the vast majority (83%) found their work environment supportive, and an equal number (8%) remained reserved to express a firm opinion or disagreed.

A perceived prerequisite for the optometrist teams' successful involvement with the programme was the quality of their relationship with the strategic programme management team (i.e. the developer team) and the schools. The interviewee considered the developer team to be very helpful. Both the clinical and administrative subteams were perceived as very efficient in their overall communication with the optometrists and the schools, in booking the school visits for the eye screening tests by accommodating the availability and needs of the community optometrist teams, responding promptly to various ongoing queries, and helping to resolve complex issues. A similar positive experience was shared regarding the collaboration with the schools involved in the programme.

The community optometrist interviewee emphasised the differences between working from their practice premises and their new role as a mobile team:

> *It's more enhanced because it's not as easy as people think. In the room [practice] you got everything there and you can just work, it becomes a routine. Where when you're going mobile you have to work around the subject, you have to work around the school timings … Yeah, so yeah, it was definitely worth it, definitely better and totally different to the practice 'cause you have to work differently… But it was a good experience, we enjoyed it.*

Seeing their involvement as important for their professional development, they expressed their willingness to remain involved in the future if there is such an opportunity. Moreover, the interviewee believed that the on-site visits (compared to the standard, practice-based way of working) were far more effective both in terms of the programme's implementation and outcomes.

Engagement

All case study school interviewees (who had participated in the programme-related training) found the engagement strategies taught at the training helpful and used them in their work. Although some strategies (i.e. raising awareness with children and parents, reminding children to wear their glasses, and giving children the spare pair of glasses) were most frequently reported, all VCs admitted that they used a combination of a range of strategies on a daily basis and acknowledged that such a combined approach was most successful in achieving their engagement goals. In addition to the strategies directed to children and parents, some interviewees noted that raising awareness of the programme among their colleagues was also a key element of their wider engagement approach. The engagement strategies that were most commonly reported were: raising awareness; communicating ongoing reminders and encouragement; encouraging children to take responsibility for wearing their glasses; providing an additional pair of glasses (resourcing and engagement); and using role models. Interviewees also reported the need to raise awareness with, and continue to remind, parents of the importance of wearing glasses.

With regard to case study interviewees' perceptions of the engagement process and its effects on the overall programme implementation, all reported positive experiences of engagement with children. However, as far as parental engagement was concerned, experiences varied across schools. For some schools, parental engagement seemed a success, while others admitted disappointing outcomes even when they '*walked the extra mile'*. The barriers to parent engagement were mostly associated with cultural differences, difficult family circumstances, lack of trust in the school system more generally, and changed priorities due to the COVID-19 pandemic. Moreover, one of the VCs noticed that, while generally engaged with the programme's implementation, parents appeared not that willing to engage in attending group information and feedback sessions. Despite the difficulties in engaging parents in some of the schools, most interviewees were content with the level of the overall parent engagement.

Children's engagement in glasses-wearing was perceived as a success in all schools.

In line with the findings from the case study interviews, the post-intervention survey examined the programme implementation strategies used by the VCs to engage with the children, who were given glasses through GiC. VCs reported a combined use of engagement strategies. All strategies apart from 'Using a timer to encourage children to keep their glasses on' (reported by only two), were selected by over 50% of the respondents. Among those, the most selected strategies were 'Reminding children to wear glasses' (86%), 'Encouraging children to take ownership and responsibility' (78%), 'Explaining the importance of wearing glasses' (72%), and 'Praising/rewarding children for wearing glasses' (67%).

In addition, the survey respondents were invited to evaluate the perceived degree of children's motivation to wear glasses, using a scale from 1 (not at all) to 5 (almost all the time). The responses revealed the following pattern. Around 25 (70%) believed that children were motivated to wear glasses most of the time or almost all the time. About 20% perceived an average level of motivation (indicated by their choice of the third scale option), and two VCs felt that the children were not at all motivated. The overall positive pattern, combined with the data regarding training attendance and strategy use, may indicate that the programme-related training has encouraged the higher use of engagement strategies, which in turn has helped to increase children's motivation to wear glasses.

Supporting glasses-wearing at school

Teachers reported that children were generally reasonably well motivated to wear classes in school (mean=5.4 on 1–7 scale) although a quarter of teacher respondents thought unwillingness to wear glasses was one of the main barriers to

participating in the GiC programme for some children. Teachers reported consistently high use of a cluster of strategies to support glasses-wearing in school:

- I/we explain the importance of wearing glasses (87%);
- I/we remind children to wear glasses if they take them off (93%);
- I/we praise and reward children for wearing glasses (73%);
- I/we use teachers who wear glasses as a positive example (68%);
- I/we provide a designated space to store the glasses if children need to take them off (62%); and
- I/we contact parents if the child didn't take glasses to school (63%).

The analysis of the parental survey responses on strategy use at school indicated similar patterns. Both parents in the intervention and BAU control groups selected 'I remind my child before school' most frequently, and more of the BAU control group parents (over half) than the intervention group parents (around a quarter) indicated that they ask their children after school. The fact that only a small number of self-selecting parents responded to the survey should be borne in mind here, and these somewhat counterintuitive results need to be treated with caution.

Only about a third of the parents in both groups confirmed that they communicated with their children's teachers. As with the glasses-wearing at home, some parents suggested that they did not need to encourage their children, who were already highly engaged. Such statements, coupled with the more frequent glasses-wearing in the intervention versus the BAU control group (as commented earlier), may at least partly explain the unexpected higher use of engagement strategies reported by the BAU control group (compared to the intervention group) parents. It may be that because the intervention group children were subjected to more engagement at school (than the BAU control group children), they were more committed to wearing their glasses at both school and home and thus did not need as much encouragement (as the children in the BAU control group) from their parents.

Glasses-wearing at home

In line with the GiC intervention design, glasses-wearing at home was not monitored by the VCs and the teachers involved. However, at the case study interviews with the VCs and the SLT members, most interviewees expressed concerns about the balance (or rather, imbalance) of wearing glasses at home and at school, which might affect the programme's outcomes. Some data was generated from the parent survey but any conclusion from this self-selecting group need to be treated with some caution.

Parents were asked: 'How much has your child been wearing his/her glasses at home?' All the intervention group parents and nearly two-thirds from the BAU control group suggested that children were wearing the glasses at home over 50% of the time every day. Higher levels of glasses breakage and/or loss were reported in the BAU control group compared to the intervention group; nearly two-thirds of the intervention group parents and slightly less than half of the BAU control group parents stated that their children had never broken or lost their glasses. About a third of the children in the BAU control group, and a smaller proportion of the intervention group broke or lost their glasses more than once. Slightly more of the BAU control group parents (around a quarter) than the intervention group parents (one-sixth) reported that children broke or lost their glasses once.

Overall, the BAU control group in the (limited response) parent survey demonstrated a somewhat higher strategy use than the intervention group. The two most frequently selected strategies by the two groups were reminding the children to wear their glasses if/when they take them off and explaining the importance of wearing glasses. Interestingly, while more than half of the BAU control parents consider it important to praise and reward their children for wearing the glasses, this strategy seemed much less common for the intervention group. About one-third of the BAU control group parents and a quarter of the intervention group parents said that they used another family member who wears glasses as a positive example.

In summary, there was widespread support for the programme, recognition of the quality of the design, and the usefulness of the training.

- The role of the VC is generally seen to be highly important, and the training received for this role was viewed very positively.
- The engagement of children was very good across the intervention schools, though engagement with parents was not always so easily achieved.
- Engagement by the school/VC with the community optometrist was generally good (though around one in six schools found communication unhelpful).
- There is some evidence that the children in the intervention group (compared to the BAU control group) were more likely to wear their glasses at home most of the time and less likely to break or lose them.

Implementation challenges

This subsection begins with an overview of the case study interviewees' perceptions of the challenges associated with the implementation process, beyond the themes previously discussed. The perceived challenges are grouped in two main themes: i) the originally designed monitoring process; and ii) related to the disruptions caused by the COVID-19 pandemic. It then proceeds to consider wider implementation challenges evidence in the surveys and at the scale of programme delivery.

Monitoring of glasses-wearing

All case study VCs expressed concerns about the amount of input required to comply with the originally designed monitoring process. The VCs' concerns were backed up by some of the SLT members. More specifically, the interviewees felt that the formal monitoring system (i.e. the 'tracker') demanded too much time to complete and was not user-friendly, which led to poor reporting outcomes in some cases.

Another important aspect of the monitoring process refers to the balance of glasses-wearing at school and home. There were concerns that some children may not be wearing their glasses at home, which in turn may affect the outcomes of the programme. The interviewees felt that they had little opportunity, if any, to monitor glasses-wearing at home.

Such monitoring processes are key to the success of the GiC programme as they are needed to inform a range of actions to ensure glasses wear (e.g. replacement, and encouraging parental support). This challenge is not unique to this trial and further work is needed to develop 'reminding strategies' as well as effective and manageable monitoring processes. For example, Huang *et al.*'s (2019) analysis of the Baltimore study highlighted the correlation between wearing glasses and parental and teacher reminders.

The impact of the COVID-19 pandemic

All schools were heavily affected by the disruptions caused by the COVID-19 pandemic since March 2020, which led to increased home-schooling time, disrupted teaching and assessment processes, increased workload for teachers and other school staff, and increased pressures on parents. These challenges impacted the following aspects of the programme's implementation and (evaluation of) outcomes:

- monitoring of glasses-wearing at school;
- delays in eye tests (refraction);
- access to glasses;
- learning gaps and gaps in measurement of academic progress; and
- disrupted programme communication networks.

As with everyone else involved in the programme, the optometrist teams suffered the effects of the COVID-19 pandemic on testing children in schools, having to adapt to a new way of working (i.e. as a mobile optician). For example, having to bring and install some of their equipment in schools and not being able to use their full equipment. The refraction and provision of an NHS voucher can only legally be carried out in approved premises and it would not have been possible to have 50 schools approved for NHS testing. In order to provide a refraction service in schools, three teams of community optometrists performed refraction tests in school and then dispensed ('gifted') the glasses to children via the

GiC programme. It is recommended that young children's initial refraction should be carried out using cycloplegic drops but in this case there was not ethical clearance to do so in schools. Where the optometrist had difficulty gaining an accurate initial non-cycloplegic refraction test, parental consent was then obtained and a further cycloplegic test performed in school. This resulted in the optometrists having to revisit the school for further testing with inevitable delays. However, these challenges were not thought to significantly impede the programme's implementation and did not have a negative impact on its outcomes.

Barriers to participation

The challenges associated with the COVID-19 pandemic (e.g. remote learning) were recognised by the largest number of VC respondents (63.9%). The next greatest challenge, according to the VCs was difficulties in monitoring the programme's outcomes (i.e. using the tracker, 38.9%). This challenge was further reflected upon in some of the recommendations for improving the GiC programme, for example: '*I think, there should be an App for parents/children where they tick every day that they have taken their glasses to school. Maybe an interactive cartoon character'*. Nearly half of the teacher respondents reported that one of the main challenges for some parents' engagement had been *'(in)sufficient understanding of the importance of wearing glasses'*. VCs also reported challenges related to insufficient engagement from parents (33.3%), difficulty to predict the balance between children's glasses-wearing at school and at home (33.3%), high demands on the VC (i.e. '*the programme requires too much involvement from me'*, i.e. 19.4%), the communication with the community optometrists (16.7%), and the number of GiC children (5.6%).

In terms of the barriers to children's participation in GiC, the most selected option by VCs was 'Broken or lost glasses' (58.3%, c.f. 40.8% of teacher respondents reported this), followed closely by 'Parents have other priorities' (e.g. COVID-related, 52.8%), then 'Absence from school beyond school closures' (27.8%). About 20% of the respondents (VCs) said that children were not willing to wear their glasses, and nearly 17% VCs felt that children were not capable of fully understanding the programme's requirements. Some (11%) VCs reported that parents were not happy with their experiences with the community optometrists, and according to 8.3% of the respondents (VCs), parents did not have sufficient information and understanding of the programme. In summary, most of these perceptions refer to various aspects of parents' engagement with the programme and, to a point, the limitations of the VC role (e.g. regarding monitoring the glasses-wearing at home).

Vision screening and communication

The process of screening, when combined with the COVID-related disturbances and the lower involvement of some schools (VCs) compared to others resulted in some problems, for example last-minute cancellations of eye tests (refraction) in schools (and, respectively, extra payments to the professional teams for rescheduled visits). Consequently, as also seen in the case study interviews and survey data, some schools complained of broken communication with the community optometrists. Moreover, the gaps in the communication between schools, parents, professionals, and the programme developer team caused some issues in the process of sharing the vision screening results.

Another challenge, which influenced the programme's implementation and outcomes at this stage, is associated with the accuracy of the eye tests provided in schools. The developer explained that due to lack of research ethics approval (hence, parents' consent), the more precise gold standard test[13] for young children for glasses could not be carried out in schools. For a small number of cases, this resulted in limited possibility of providing accurate prescriptions and may explain the confusion of some parents as indicated by the survey and case study interview data presented earlier in the report.

Parental engagement

This theme of parental engagement emerged throughout the interviews and surveys, indicating a potential area for improvement. The problem of insufficient or unhelpful parent engagement was most noticeable at the stage where children were prescribed glasses. One teacher survey respondent explained that

[13] The gold standard approach uses cycloplegic drops to dilate the pupil and prevent the lens changing focus in order to provide an accurate prescription.

> *… in the beginning some parents did not take children for the appointment. Despite our best efforts this continued and was then impossible to deal with due to lockdown. Having the eye test and delivery of glasses to school [in year 2 of the study] really helped as finally the children had glasses to wear.*

Although appreciated by most participants, the provision of glasses in school appeared a double-edged sword for some. For example, some of the professionals complained about the unexpectedly high administrative workload, most likely associated with the higher numbers of children going to one practice compared to another. Yet, perhaps most unexpected was the reaction of a small number of parents, who disapproved of their children being given school glasses; they simply did not like the glasses that were being provided through the GiC programme. According to the developer, this effect may be a reflection of the parents' socio-economic status, where parents with lower socio-economic status may have been more appreciative of the GiC programme compared to those with higher socio-economic status.

The optometrist suggested how to address this issue in the future:

> *If the child is happy with the glasses, they'll wear them. So, if they choose the colour, the style, everything, they'll tend to wear them more, but parents, they don't like their children wearing funky glasses. So, I think if they did the scheme [programme] again, I would say that let the child choose a pair of glasses in school and then either invite the parent into the school or invite the parent to the practice to choose the pair they want them to wear around the house. So, there's the school pair the child will be wearing all the time, so they'll [children] be helping with that in school and the other pair the parents will be happy with, so they got two different types of pairs of glasses.*

With regard to engaging with parents and monitoring glasses-wearing in schools, it was emphasised again that the efficiency of the VCs was a key factor for the success of the programme's implementation. Parental engagement might be enhanced by sending more frequent reminders to parents regarding the various stages of the programme's implementation and the potential benefits for their children of being involved, beyond the initial information package and consent form.

Partner engagement

The developer highlighted the important role of the healthcare team, including community- and hospital-based professionals (orthoptists, optometrists, and ophthalmologists). Thus, setting up and maintaining a reliable team of professionals was crucial for the programme's success. The developer considered the major challenges in this context to be the recruitment of, and payment to, the community optometrists and this has potential implications for the programme's implementation. For example, the local optometry community were reluctant to work with the initially suggested private optical company, which opened a new process of communication between the developer and the chair of the Local Optical Committee (LOC) in the second year of the programme's implementation. This productive collaboration led to the LOC distributing an expression of interest form to all local optometry practices, which in turn secured the recruitment of three contracted optometrist teams. Moreover, by that time, only one out of the three contracted teams had experience in testing large numbers of very young children in the way required by the GiC programme.

Paying the contracted optometrist teams also proved to be complicated, and delays throughout the payment process appeared to affect some aspects of the programme's implementation. In year 1 of the study, the delay caused by the challenges of recruiting the community optometrist teams resulted in a second payment to the professionals, in addition to the voucher value for the children's NHS eye test and glasses. In year 2 of the study, the developer team had to negotiate a contract with the professionals, where additional costs for going into the schools (including extra costs for personal protective equipment, etc.) had to be incorporated. This process was further complicated by the need to cancel and/or reschedule school visits due to the COVID-19 disruptions.

The optometrist identified a gap in the programme's overall implementation process and suggested:

> *[It] would be better to have more history of the child 'cause we were going into schools blind. We didn't know anything about this child, but like the clinical team, they knew everything about this child. So I don't know how it would work, but if you had a bit more information about the child, so like this child has had glasses before and they've got something wrong with this eye or that eye or whatever it was, it just helps*

us while we're testing the child as well so we know what we're looking for, so just extra information would have been better.

The challenges to implementation can be summarised as follows:

- glasses trackers were onerous and therefore not used very effectively;
- the COVID-19 pandemic impacted various aspects of the intervention (and evaluation) despite the best efforts of all concerned to mitigate the impact;
- loss and/or breakage of glasses is a constant threat to such an intervention;
- parents are critical to the success of the programme but maintaining their active support is not easy to achieve or monitor. In some instances, parents were unhelpful (e.g. at the prescription stage), either by not making/keeping appointments (year 1 of the study), or not liking the glasses dispensed in school; and
- arrangements with (private) optometrist teams can present challenges to the smooth running of the programme and need to be carefully set up and managed.

Impact on children, parents, and school staff

Impact on children

The VC survey highlighted two programme aspects as most beneficial for children: 'Providing an additional pair of glasses at school' (91.7% of respondents); and 'Providing an early eye testing' (81% of respondents). Over 40% of the VCs also felt that the programme helps in supporting parents to look after their children's health. When prompted to share their perceptions of specific programme-related benefits for the children involved, over 80% observed that the programme helped children to focus better on their school work, 50% believed that the programme contributed to improving children's academic performance, over 36% perceived positive effects on children's psychological well-being (e.g. confidence and happiness), and 25% were convinced that the programme helped children to develop important social skills through extended experiences such as communication with the community optometrists and choosing their own glasses. No one seemed to think that the programme had not led to any benefits for the children.

All case study interviewees were confident in both the observed and anticipated benefits of the GiC programme for their pupils. These perceptions refer largely to benefits for children's academic and social learning, behaviour, and physical and psychological well-being. Most appreciated the programme's potential of having a multi-faceted positive effect.

The perceptions that the evaluation of any impact of the programme on children's academic learning could be impeded by the COVID-19 disruptions were prevalent among the interviewees for two main reasons. First, as discussed earlier, it was generally believed that because of the disruptions, and resulting extended home-schooling time, some children may have not worn the glasses as much as expected and/or may not have completed remote learning activities. Second, there was a lot of uncertainty about how pupil's academic progress has been measured during the lockdowns in 2020/2021 and the following recovery period. Despite these concerns and reflecting upon some behavioural indicators that they have already observed, all interviewees expressed their belief in the positive longer term impact of the programme on children's academic learning. Moreover, it was widely acknowledged that the children have also benefited from the GiC intervention in terms of their social learning, not just academically.

None of the interviewees seemed to have any doubts in the programme-related benefits for children's physical and psychological well-being. References to well-being categories such as 'the ability to see better', 'happier', and 'more confident' were frequently made during the interviews.

Impact on parents and school staff

Although not directly targeted by the programme, parents and school staff played a key role in the programme's implementation. The VC survey respondents communicated their perceptions of a wider range of benefits for various groups of people. For example, over 70% of VCs admitted that the programme increased their awareness and knowledge of glasses use, 50% of VCs felt that the programme has influenced changes in parents' attitudes to glasses-wearing through (again) increased awareness and knowledge and raised awareness of glasses-wearing among school staff more widely (38.9%). Importantly, over 36% of VCs noticed that the programme impacted positively even those children in the school who were not involved in it but were wearing glasses, by making them more aware and willing to wear their glasses. Overall, the findings regarding the perceived programme-related benefits demonstrate that a much

wider range of positive effects beyond those, initially hypothesised (i.e. in terms of academic achievement), may have been achieved.

According to the case study interviewees, the parents benefited mostly from improved knowledge and increased awareness of the reasons for and importance of wearing glasses at an early age. Consequently, many parents did not just give consent for their children to participate in the programme but were also eager to encourage and monitor glasses-wearing.

In a similar way, interviewees saw benefits in increasing their own knowledge of the specifics and benefits of glasses-wearing. Many felt that their colleagues have generally become more aware and interested in the topic. Some reported: i) behavioural changes, where for example they've become more proactive and focused on encouraging children to wear glasses; ii) changed the ways they'd used to wear their glasses; and iii) identified improvements in their everyday practice as well as overall personal/professional development. One VC decided to apply for career progression, following her experience with the GiC programme.

Unintended consequences

Finally, a few of the interviewees thought that there were some unexpected, yet positive consequences of the programme's implementation. One of these consequences refers to the impact of the programme's implementation on children wearing glasses beyond those involved in the programme. In another school, a child with a serious eye condition was diagnosed earlier because of the GiC programme and that led to an early intervention to support this child. Moreover, many felt that if it was not for the extra pair of glasses, some children would have remained without glasses (e.g. due to closures of some services) during the lockdowns.

Despite the widespread acknowledgement of the programme-related positive effects discussed above (some of which were not planned through the original programme design), when asked directly if there were any unintended consequences of the programme's implementation, only a small number of respondents replied with 'Yes' (8%) or made any comments (8%). Overall, the comments referred to examples of success, where some parents changed their initial negative perceptions of glasses-wearing as a result of the GiC information campaign. In terms of VCs' attitudes to their (potential) longer term involvement with GiC, nearly 90% of VCs said that they would like to remain involved, thus confirming their willingness to sustain the programme in the future. Moreover, nearly 90% of VCs said that they would recommend the GiC programme to other schools and colleagues.

In summary:

- VCs largely agree (80%) that the GiC programme improved children's focus on learning; half believe the programme improved academic performance; around one-third saw wider psychological/well-being benefits, and a quarter reported more general social impacts.
- Although VCs found it difficult to communicate with parents given the broader context in education, they reported improved awareness of the importance of, and support for, glasses use.
- Vast majority of intervention schools valued the programme, wanted to remain involved, and would recommend it to other schools.

Scaling up

The developer interview explored how the GiC programme could be scaled up in the future. First, the programme could be extended and improved by obtaining ethical approval for conducting the more accurate 'gold standard' cycloplegic eye test for children in schools. This would improve the prescription accuracy and could potentially increase the uptake from parents.

Second, further applications of the programme should consider the best practices regarding the recruitment and the support of the VCs, both initially and over time. For example, the experience over the past 2 years demonstrated that the VCs who had less access to children (e.g. because of their main role), worked with high numbers of children, and/or took responsibility for more than one school were less efficient in sharing vision screening information and monitoring glasses-wearing.

Third, it seems that full eye testing (refraction) in school for those children failing vision screening, though probably more costly, would mitigate the varied support and engagement of parents and ensure more equitable access to testing and initial dispensing. This was both a necessity and an opportunity afforded by the pandemic. However, in normal circumstances, the community optometry practices may prefer to focus on their usual business rather than collaborating on the programme in this way. The overall implementation process could also be adapted so that parents are given the option to attend the optometrist independently (BAU) and provide the school with the spare 'school' glasses or to participate in the GiC programme and receive both pairs of glasses via the school ophthalmic team. This approach might best balance the needs of under- and over-engaged parents/carers.

Fourth, a potential scaling up of the programme should consider the wider context at least in terms of socio-economic status and geographical area. For example, while the area of Bradford has a relatively high number of optometry practices, this may not be the case for other geographical areas. The school sizes and numbers of children may also vary significantly across areas. Hence, a somewhat hybrid programme design considering the contextual characteristics may be a better solution than a uniform design. Moreover, the programme's implementation coincided with the COVID-19 pandemic.

In summary:

- The training and role of VCs might need to pay greater attention to the challenges presented in different contexts and by different role-holders.
- The location and process for initial screening, testing, and dispensing could be redesigned to maximise parental engagement and subsequent glasses use.

Costs

Table 16 sets out the costs of delivering the GiC intervention as designed and under normal conditions, assuming no major interruptions (e.g. pandemic/school disruption). It also assumes full uptake of tests (c.f. 30% missed appointments in practice), which all result in dispensing of glasses, and thereafter a 10% loss/breakage rate (estimated from the impact evaluation/IPE data). The developer reports the actual glasses cost in year 1 of the study to be £8,500, which is a good fit to fit our assumptions. For example, 54.6% of referred intervention children received an additional school pair in year 1. At that rate, with 100% conversion from triage to prescription, the total cost would have been c. £15,600, which is close to the full estimated cost below.

Table 16: Cost of delivering the GiC programme

Item	Type of cost	Cost	Total cost over 3 years	Total cost per pupil per year over 3 years
Year 1: community optometrist testing and dispensing of glasses (high street)	NHS vision screening (BAU) NHS sight test (free) NHS glasses voucher (home pair)	£0 £0 £0	£0	£0
Year 1: community optometrist testing and dispensing of glasses (high street)	NHS glasses voucher (school pair) (voucher varies from £39.10 for single vision to £215.50 for strong complex bifocal lenses)	£44 per pupil * 403 pupils =£17,732	£53,196.00	£132.00
Year 1: replacement costs	NHS glasses voucher	£44 per pupil * 40 pupils (i.e. 10% estimate) = £1,760	£5,280.00	£13.10
Year 1: school staff costs	VC role in schools VC training (1 day)	£0 (subsumed into budget) £150 (supply costs) * 50 = £7,500	£0 £22,500	£0 £55.83
Year 1: liaison costs	Communication (email, calls, feedback)	10 hours per month * £25 per hour * 10 month = £2,500	£7,500	£18.61
Total			£88,476.00	£219.54

BAU, business as usual; GiC, Glasses in Classes; NHS, National Health Service; VC, vision coordinator.

It should be noted that the costs in the intervention are, by and large, incurred by local health teams (screening, testing, dispensing) and not directly by schools. We have therefore not included a cumulative cost per pupil over 3 years *to schools*, which would, as noted below, be impacted by the final mode of delivery.

As reported herein, there were considerable changes to the implementation due to the pandemic. This impacted the costs in two important ways:

- Increased ‘loss’ of glasses from school to home-schooling environments, which were then not returned to school. This is, assuming replacement, an additional cost, which would not have been incurred in normal circumstances.
- The more substantial cost was the move to contracting optometrists to undertake testing in schools in the context of the pandemic. While the dispensing costs remain unchanged, there was considerable additional cost for this activity. The developer paid a locum rate for an optometrist and dispensing optician but due to COVID absences and impromptu school closures (resulting in repeat visits) the cost of staff was high. Combining the additional staff costs and glasses cost was on average £65,000 in total (glasses alone cost £18,200). This was a considerable additional cost over and above the normal (BAU) vision screening, and free eye tests undertaken at optometrists. We have not attempted to fully detail this cost scenario given the complexity and unique circumstances. However, we do conclude below that there were benefits to in-school

testing and dispensing so a more careful cost analysis of that scenario (without COVID-related glasses attrition) would be worthwhile.

Conclusions

Table 17: Key conclusions

Key conclusions
Children in the Glasses in Classes (GiC) treatment schools made no additional months' progress in reading compared to children in the business as usual (BAU) control schools. This result has a moderate security rating.
Exploratory analysis suggests that children in the GiC treatment schools did not have improved visual acuity compared to children in the BAU control schools, although both groups showed some improvement. Children who were offered GiC also did not show any improvement in the other secondary outcomes of reading decoding, auditory processing, and phonetic coding (Word Attack subscale) and quantitative knowledge, mathematical achievement, and quantitative reasoning (Applied Problems subscale).
Children eligible for Free School Meals (FSM) who were offered GiC made the equivalent of one months' progress in reading. Children eligible for FSM who were offered GiC did not show any improvement in the secondary outcomes of: 1) visual acuity; 2) reading decoding, auditory processing, and phonetic coding; and 3) quantitative knowledge, mathematical achievement, and quantitative reasoning, compared to children in the BAU control schools. However, these results have high statistical uncertainty.
Over 95% of teachers surveyed were supportive of the GiC intervention and would recommend it to other schools. Of the vision coordinators (VCs) surveyed, 80% thought that GiC enabled better focus on schoolwork; half thought GiC helped to improve academic performance and over one-third perceived positive effects on children's psychological well-being.
The impact of the COVID-19 pandemic on schools, families, and optical services disrupted both programme delivery and aspects of the evaluation. VCs and teachers interviewed generally believed that children may have not worn the glasses as much as expected and/or may not have completed remote learning activities and there was uncertainty about how pupil's academic progress has been measured during the lockdowns in 2020/2021 and the following recovery period.

Impact evaluation and IPE integration

The goal of the impact evaluation was to assess the degree to which visual acuity and academic achievement in literacy and numeracy were improved in the treatment schools compared to the BAU control schools. It included measures of fidelity and compliance, though these became challenging to manage during the turbulence in schools resulting from the COVID-19 closures and disrupted recovery periods.

The IPE set out to understand the experiences of VCs, classroom teachers, and parents, as well as the view of the developer and community optometrists. This was based on several surveys, the post-intervention ones being framed by findings from initial surveys. In addition, six school case studies (in treatment schools) provided more in-depth interview evidence from senior leaders, VCs, and teachers.

Evidence to support the logic model

As originally designed, GiC was designed to ensure that young children (aged 4–5) receive and use glasses if needed, and in particular at school, in order to improve health outcomes (i.e. visual acuity) and educational progress (i.e. literacy, numeracy). The original, pre-pandemic logic model (see Figure 1b) proposed three broad mechanisms for achieving this:

- effective communication between families, schools, and the health service;
- increased knowledge of best practices in glasses adherence for children to promote outcomes; and
- effective intervention materials, activities to promote glasses adherence.

The revisions to the inputs in the intervention resulting from the pandemic added another mechanism to the model:

- children needing glasses get them at home and in school.

These mechanisms were hypothesised to lead to the following outcomes:

- coherent school mission, policies, and higher standards;

- increased capacity to support children's learning in higher quality learning environments;
- improved parental involvement;
- increased glasses wear; and
- improved visual acuity and academic achievement (for children).

The impact evaluation results for the GiC intervention found no clear effect for the treatment group compared to the BAU control group, either upon academic achievement in literacy and numeracy, or on visual acuity. This applied both for the full sample or for FSM-eligible subgroup of pupils. That said, both groups on average did show improved visual acuity.

Despite this, there was widespread support for the intervention from survey participants (teachers and VCs) and a keenness to not only continue this work but to encourage other schools to participate. This mismatch relates to three problems, one highlighted by the variation between the initial and updated intervention design, and two others resulting from implementing GiC during the tail end of a global pandemic with its ongoing disruption to education and other services.

The first of these problems is concerned with ensuring that those children who need glasses actually get them. In the original design, obtaining glasses relied on parents/carers to realise key steps in the process from screening to testing to dispensing. Getting any glasses at all is a precursor to getting a second pair of 'glasses in classes'. So, for those children who do get their glasses, teachers and VCs can see the benefits of having an additional pair in schools. The revised intervention went a long way to addressing this issue.

The second problem highlighted by this mismatch between the qualitative analysis of the IPE and the findings of the impact evaluation is the length of time for the impact of the updated process (i.e. in-school testing and dispensing) to take effect. This is highlighted clearly in Figure 7, which shows that a substantial proportion (around one-third) of the intervention group participants might not have had their glasses (in classes), and certainly not an updated prescription, in the 8 weeks before the post-test, which is arguably insufficient to detect an effect.

The third problem, and compounding this timing issue, the prevalence of periods of home learning (either individually or collectively) in all likelihood reduces the intensity of glasses-wearing and certainly reduced the opportunities for teachers to remind children about their glasses-wearing.

We suggest that had the revised model been used from the outset, without the delayed testing/prescribing caused by the ongoing COVID disruption, or the reduced encouragement/monitoring due to remote schooling, it is much more likely that an effect in the outcomes would have been detected between the intervention and BAU control groups. That said, such a change in process to the year 2 delivery model would raise legal issues that would require consideration. Furthermore, it is worth remembering that children in the BAU control group in this trial did not have *no glasses*, but would have experienced the normal vision screening, with the opportunity to obtain a single pair of glasses, and these could be worn in school or during remote schooling.

More generally, the IPE showed that all three of the original mechanisms could be improved in future iterations of the programme, to increase consistency of training, monitoring, strategies, and communications. The additional mechanism is critically important and specifically focuses on the process for the initial screening, testing, and dispensing of glasses. This amended version takes account of the different types of parental engagement.

- Timely and accurate school-based vision screening and dispensing with sufficient flexibility to encourage engagement by different parent groups.

While this could be construed as part of 'effective communication ...' it is a critically important first step that warrants its own *mechanism*. The evaluation shows that the original design, and the adapted design resulting from the COVID disruption, both have merits and demerits in this regard. Getting this process right, particularly for those children from backgrounds less likely to be supported with glasses wear at home, is likely to make a considerable difference.

If future trials of this approach wanted to retain the original implementation design (i.e. parental responsibility for attending vision testing) then there would need to be a much tighter follow-up process. Another option would be a hybrid

model whereby more engaged parents/caregivers (a majority) could proceed as in the original design, but with a later sweeping-up phase of in-school testing and dispensing for a minority of children whose families have not engaged with the eye testing process, although further consideration needs to be given to reduce complexity of implementation in any hybrid model where possible. The key principle in any revised design would be to ensure, first of all, that all those children who need glasses get them. Only then can additional 'glasses in classes' have the maximum benefit for all children.

Interpretation

With compelling prior evidence (Neitzel *et al.*, 2021; Maconachie, *et al.,* 2016) of the impact of ensuring appropriate glasses wear for learners at the start of school—on visual acuity and thereby learning outcomes—it is disappointing that the present study has been unable to show significant evidence of such an effect. In contrast, teachers and VCs were overwhelmingly enthusiastic about the programme and keen to see it rolled out more widely. The COVID disruption has hampered both the implementation timelines and disrupted monitoring and evaluation processes. Even when schools returned to some semblance of normality, there was for many months of disruption in schools, families, services, and associated challenges for communication and collaboration. For example, different levels of concern about health and safety in relation to COVID did not always aid the timely reassessment of visual acuity in children, either in schools or through opticians. All of that said, the silver lining of this context is the new insights that are afforded by implementing two different models. This has, in our view, helped to further highlight weaknesses in the original implementation design and multiple potential ways forward.

Limitations and lessons learned

Evaluation limitations

The size of the sample was just enough to be able to meet the MDES requirements of the EEF and included a sizeable proportion of the Bradford primary schools. While this is advantageous for the intensive support for delivering such an efficacy trial, it meant the demand on local resources for quick triage in year 1 of the study was intense. Similarly, when adapting the methodology in year 2 of the study, the challenge of testing and dispensing in a timely manner was made more challenging by the need for repeated visits (e.g. for additional cycloplegic tests) and due to higher than normal rates of child absences, unplanned school closures, and the like (see Figure 7). A more dispersed area for the trial would have helped to mitigate this problem, though would have increased the planning and administrative demands on the developer in those stages. While those aspects of the intervention could have been managed differently, what was more difficult to control was the rate of attendance at eye appointments in year 1. Significant non-attendance, and more often by disadvantaged learners, affected the ability of the evaluation to detect primary and secondary effects.

The COVID-19 pandemic impacted this in two ways. Due to the reduced access to community-based optometrists through the pandemic, the move to school-based testing and dispensing in year 2 addressed this earlier problem in part. Yet this also increased the demand on optometrists visiting schools at a point where education and workplaces were being unpredictably impacted by the vagaries of COVID. As a result, the problem shifted from being one of non-attendance (by families/children) at eye tests to one of delays of school-based tests.

Another impact of COVID was the move to home learning, which in all likelihood reduced glasses wear, and certainly made it difficult to track glasses use. That is not to say that teachers and VCs found the tracking of glasses-wearing straightforward. One of the clearest complaints raised by teacher/VCs was the burdensome process of using the glasses trackers. This was made more difficult in schools with large numbers of children in the trial, or where there were changes of staff.

Lessons and future evaluations

There are four main lessons to be learned from the evaluation that might improve future versions of the GiC programme.

1. **Eye test (refraction) and dispensing**: Careful consideration should be given to the most effective way of ensuring that those children who need glasses can get 'glasses in classes' that they want to wear in a timely fashion. First, this requires an intensive period of testing and in future this might require a shorter, more intensive burst of activity. Second, consideration needs to be given to where testing should take place; in high street

opticians or in school. There are cost implications for a school-based approach to testing and dispensing, in part because that would mean that all children who need a full test would get one, which our evaluation evidence suggests does not happen. On the one hand, a school-based approach to testing and dispensing—at least for this first stage of primary schooling—would ensure that all children who need glasses to support their learning get them. This aligns with research in China and the United States that has shown that provision of glasses to schools is more effective than provision of prescriptions to parents in improving children's vision and is associated with better educational outcomes (Neitzel *et al.,* 2021; Glewwe, West, & Lee, 2018; Nie, Pang, Sylvia, Wang, & Rozelle, 2018). However, the evaluation has also highlighted the unhappiness of some parents who want to exercise greater agency in their child's glasses choices. We suggest that this could be accommodated into a school-centred approach as follows: i) initial vision screening takes place in school with results sent home, then normally: ii) following eye tests in schools, glasses are dispensed for both school use and for home use, unless; iii) parents opt for a single pair to be dispensed for school use, with a voucher being provided for them to choose a home pair with their child at an optometrist of their choice, which can be supplemented if they chose a home pair. This approach would have a much stronger chance of ensuring that those less likely to have the home support for glasses wear do get tested and do have glasses. It would also mean that schools can start from full compliance at the start. A final aspect of this first area for consideration is the quality of the test, where there is a play-off between the cost of better testing with the added value. Our view is that the greatest gain would be had by ensuring testing and dispensing for all.

2. **VC role:** The VC role is centrally important to the effective implementation of the intervention and greater consideration needs to be given to the best person to take on this role and what it entails in different contexts. This is particularly important when several teachers are involved in the intervention and communication with parents and visions services requires more of a coordination role.

3. **Tracking:** The glasses trackers used as part of the evaluation were generally disliked and not completed well. Future evaluations would benefit from better monitoring tools and participants suggested different app-based or school information system approaches. There would be some value in working with users (i.e. teachers) to design less administratively burdensome tools for this aspect of the evaluation. This is particularly important, not only as part of the evaluation, but also as part of the trial given the evidence that reminders by teachers and parents is associated with observance of actual glasses wear (Huang *et al*., 2019)

4. **Communication with parents/carers:** The evaluation has identified variable understanding of, and engagement with, the GiC intervention. The first point above would address some of the negative effects of under-engagement in the initial stages of the intervention but there remains a need to communicate more consistently and effectively with parents regarding the importance of the intervention and how they can support it. In future, it might be that some of the successful strategies from this present evaluation can for the basis of advice to parents/carers.

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Appendix A

Cycloplegic refraction: A refraction where ‘cycloplegic’ eye drops are used to dilate the pupil by paralysing the muscles (ciliary muscle), which focus the lens. The effect is that the eye cannot focus on near or intermediate objects and as a result, the true refractive error can be measured. The eye drops may be unpleasant for children as they sting.

Dispensing optician (DO): The main role of a DO is to advise on, fit, and supply the most appropriate spectacle frames and lenses for each person.

Ophthalmologist: An ophthalmologist is a medical doctor who specialises in eye and vision care.

Optometrist: Previously known as opticians, optometrists are trained to examine the eyes to detect defects in vision, signs of injury, ocular diseases, or abnormality. They prescribe glasses or contact lenses.

Orthoptist: Orthoptists primarily diagnose and treat defects in eye movement and problems with how the eyes work together, called binocular vision. They are specialists in assessing vision in children and those with communication difficulties.

Refraction: A refraction is an eye examination that measures a person's prescription for eyeglasses. While adults can answer subjectively about which lens is better (subjective refraction), this can be unreliable in children, so a more objective examination is conducted where a light is shone into the eye through different lenses (objective refraction). Variability that occurs as a child attempts to focus may affect the measurement therefore typically cycloplegic refractions are performed with young children.

Vision screening: Vision screening allows the detection of reduced vision in one or both eyes at an age when treatment has the potential to improve vision. The UK National Screening Committee (UK NSC) recommends that screening of children’s eyes should be offered to all children aged 4 to 5 years. This service should be organised and led by specialists (orthoptists). For further information, please see: https://view-health-screening-recommendations.service.gov.uk/vision-defects/.

Appendix B: The EEF cost rating

Table 18: Cost Rating

Cost rating	Description
£ £ £ £ £	*Very low:* less than £80 per pupil per year.
£ £ £ £ £	*Low:* up to about £200 per pupil per year.
£ £ £ £ £	*Moderate:* up to about £700 per pupil per year.
£ £ £ £ £	*High:* up to £1,200 per pupil per year.
£ £ £ £ £	*Very high:* over £1,200 per pupil per year.

Appendix C: Security classification of trial findings

Rating	Criteria for rating			Initial score		Adjust		Final score
	Design	MDES	Attrition					
5	Randomised design	<= 0.2	0-10%	MDES 0.195				
4	Design for comparison that considers some type of selection on unobservable characteristics (e.g. RDD, Diff-in-Diffs, Matched Diff-in-Diffs)	0.21 - 0.29	11-20%	Attrition 13.6%				
3	Design for comparison that considers selection on all relevant observable confounders (e.g. Matching or Regression Analysis with variables descriptive of the selection mechanism)	0.30 - 0.39	21-30%			Adjustment for threats to internal validity [X]		x
2	Design for comparison that considers selection only on some relevant confounders	0.40 - 0.49	31-40%					
1	Design for comparison that does not consider selection on any relevant confounders	0.50 - 0.59	41-50%					
0	No comparator	>=0.6	>50%					

Threats to validity	Threat to internal validity?	Comments
Threat 1: Confounding	Low/Moderate	RCT design. Baseline balance was -0.04 for the primary outcome, Balance ranged between -0.08 and -0.02 for secondary outcomes. Controlled for in the pre-test scores.
Threat 2: Concurrent Interventions	Low	None reported
Threat 3: Experimental effects	Low/Moderate	IPE results suggested the BAU higher than expected use of engagement strategies by BAU parents.
Threat 4: Implementation fidelity	Moderate/high	Poor fidelity pre-pandemic, difficult to monitor glasses-wearing and a lot of disruption to implementation due to covid.
Threat 5: Missing Data	Low	Missing data appropriately dealt with in model
Threat 6: Measurement of Outcomes	Low	Plots suggest no issues with this measure
Threat 7: Selective reporting	Low	Adhered to reporting standards

- **Initial padlock score: 4 (attrition 13.9%)**
- **Reason for adjustment for threats to validity**: Drop 1 – intervention disruption and suggestion of experimental effect
- **Final padlock score:** initial score adjusted for threats to validity = 3

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