SIMETRICA Jacobs

Healthy Brains:

An Evaluation of Evolve's Project HE:RO and associated programmes

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The Health Foundation

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Executive Summary

Evolve's Project HE:RO (Health Engagement: Real Outcomes) and their new and innovative programme under development, Engine Room, target children at risk of school exclusion. Children who show poorer cognitive functioning and wellbeing and which are at risk of school exclusion will likely grow up and develop adult social ills, such as committing more crimes, relying on welfare benefits, displaying more unhealthy habits (e.g. overweight, smoking cigarettes), and reporting more hospital stays and insurance claims.

The Project HE:RO programme recruits a 'Health Mentor' for each school to administer treatment programmes, assist teachers in classes, and run activities with children in the school. These intervention programmes use measures (i.e. Wellbeing Compass scale and Stronger Brains tasks) to assess and improve their wellbeing and cognitive functioning. The Wellbeing Compass scale assess a pupil's wellbeing by asking pupils to self-report on their physical activity, diet and nutrition, personal wellbeing, emotional development, and cognitive functioning. Stronger Brains has co-developed assessments and exercises with Posit Science. Posit Science is the owner of the prominent brain training programme, BrainHQ, a validated cognitive task set widely used in the adult population. Stronger Brains tasks were designed as computer games that measure a variety of cognitive functions (e.g. processing speed, visual-spatial memory, executive functioning). Children who score in the lowest percentile in their cohort in wellbeing and cognitive functioning are recruited into programmes to facilitate healthy brain development.

Prior research has established how important children's wellbeing and functioning is in their long-term development. With physical activity, diet and nutrition in children shaping healthy adult behaviours, emotional and social development linked to mental health and later social behaviours, and childhood cognitive functioning linked to adult health literacy. However, most children's wellbeing research is conducted without the support of a mentor (e.g. Health Mentor), which is contrary to what is recommended in educational research.[1] Long-term mentorships (e.g. at least 12 months) have been shown to facilitate leadership skills, form quality social relationships, increase physical activity, pursue higher education, and encourage volunteering in their community. While children's brain training has previously been used, brain training effects in school populations have not been the focus. Brain training programmes using Stronger Brains-like tasks (BrainHQ) with children have only ever been conducted in clinical trial. The Project HE:RO programme is the first to target both brain training and wellbeing development in vulnerable children through the support of a mentor in a school setting.

This report aims to establish the impact of the Project HE:RO intervention in vulnerable school children. By using a quasi-experimental method, pupil's wellbeing, as measured by the Wellbeing Compass scale, and cognitive functioning, as measured by the Stronger Brains

[1] Baldwin Grossman & Tierney (1998). Does Mentoring Work? An Impact Study of the Big Brother Big Sisters Program. Evaluation Review.

task set, was tracked for both pupils participating in the programmes and those who don't over the course of the school year (2018-2019). The key findings are as follows:

- The Project HE:RO programme was found to significantly increase pupils' wellbeing as measured by the Wellbeing Compass.
- Evolve's new programme, Engine Room, was found to significantly increase pupils' cognitive functioning as measured by Stronger Brains tasks
- Strong associations in both direction between Wellbeing Compass and Stronger Brains task performance suggest that improving pupil's wellbeing can lead to improved cognitive functioning and vice versa.

These findings are important because this research targets a vulnerable population, children at risk of school exclusion, to reduce the potential well-known long-term effects of exclusion. While these measures (i.e. Wellbeing Compass and Stronger Brains tasks) are yet to be validated with pupils of this age, these preliminary findings suggest positive impacts on children's wellbeing and brain health through Project HE:RO. Future research should look to recruit larger sample sizes, collect more data around pupils (i.e. sociodemographic, educational outcomes) and observe changes over longer periods.

Year 6 teacher talking about three pupils in Project HE:RO:

"Whatever you're doing, it seems to be going well. They are definitely improving their focus in class. I'm definitely noticing a difference"

Parent of a child in Project HE:RO:

"The Hero Club was such a fantastic thing for my son, especially when we were going through a difficult time as a family."

Year 3 teacher talking about how much a child has changed in class since starting the Engine Room:

"He never gives up and he's always willing to try challenges...He can remember facts from History and Geography learned weeks ago."

1 Introduction

Evolve commissioned Simetrica-Jacobs to analyse the impact of Project HE:RO and their new programme in development, Engine Room, on the brain health of primary school pupils who took part in the programme. In this report, **brain health refers to the all-encompassing cognitive and mental health of an individual**.

Project HE:RO focuses on children and young people in the UK who are not exhibiting positive learning behaviours and/or social and emotional issues, which may be the result of early childhood trauma. Trauma can have significant consequences for child development,[2] where children 'switch-off' from education and exhibit negative behaviours that often lead to school exclusion. School exclusion can negatively impact various aspects of adult development and be passed onto later generations. These follow-on effects are shown to have significant impairments to public welfare, resulting in large human and monetary costs.

The Project HE:RO programme was motivated by research from neuroscientist Dr. Michael Merzenich[3], Professor Emeritus at the University of California at San Francisco. Dr. Merzenich is a world authority on the brain's ability to change and adapt from experience and environment, also known as its 'plasticity' or 'neuroplasticity'. This plasticity can be utilised to rejuvenate, remodel, and reshape brains at any age. Project HE:RO seeks to use this research to improve the short- and long-term brain health of British children and young people.

Project HE:RO aims to reverse negative impacts on brain health through early interventions in primary schools. These interventions, delivered by trained Health Mentors, were designed to facilitate the brain's plasticity. The support provided by Health Mentors includes physical activity interventions, mentoring workshops, health education lessons, and in some cases, personalised cognitive training delivered via a digital platform (i.e. Stronger Brains tasks in the Engine Room programme).

The two interventions which are the focus of this report are:

- **Project HE:RO (Health Engagement: Real Outcomes)**: a weekly mentoring programme designed for pupils with medium-to-high learning needs[4], and
- **Engine Room**: a daily 12-weeks long programme of brain training computer games for a small cohort of 11 students with higher learning needs.

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[2] Gill, K. et al. (2017) Making the Difference: Breaking the link between school exclusion and social exclusion, Institute for Public Policy Research

[3] Merzenich, M. (2013) Soft-Wired: How the New Science of Brain Plasticity Can Change Your Life, Parnassus Publishing

[4] Learning needs is loosely defined as greater difficulty attending and participating in class (this may include behavioural problems) and therefore display greater 'switching off' characteristics.

In this analysis, we evaluate primarily the efficacy of Project HE:RO. Results for the Engine Room intervention are presented alongside but the relatively low sample size limits the power of the analysis.

Evolve programmes have been successfully administrated in more than 245 schools during the school term since 2014,[5] with more intensive programmes over the school break.[6] Senior educational leaders have declared seeing improvements on school readiness in pupils and as a result, have employed Health Mentors for Project HE:RO support on a full-time basis for over 50 schools across England and Wales.

This Healthy Brains report aims to:

- Evidence the impact of the programme on pupils' brain health
- Better understand under which conditions the programme performs best
- Unfold the link between wellbeing and cognitive health

The report is structured as follows. Section 2 discusses the academic and grey literature that informs the Project HE:RO and Engine Room programmes. The delivery of the interventions and analysis methodology are detailed in Section 3. Section 4 summarises our results. Conclusions on the evaluation of the interventions are drawn in Section 5 with key takeaways and recommendations for going forward. Section 6 contains the report annexes.

2 Review of existing literature

2.1 Children's development & behavioural problems

Children excluded from school are found to display increased vulnerability later in life, wherein excluded children are more likely to be in the care of the state, have grown up in poverty, have special education needs, and suffer from recognised mental health problems. **Permanently excluded children will cost the state an extra £2.1 billion in education, health, benefits and criminal justice costs[7].**

A longitudinal study based in Dunedin, New Zealand, the Dunedin Multidisciplinary Health and Development Study has studied the physical, mental, and cognitive health of a 1037 cohort.[8] The study aim was to identify differences in the prevalence of problems in adulthood between adults with adverse childhood backgrounds to those adults without adverse

[5] https://www.evolvesi.com/codeless_portfolio/ffaldau-primary-school-pontycymmer-bridgend/

[6] https://www.evolvesi.com/codeless_portfolio/the-firs-branches-out-with-project-hero/

[7] Gill, K. et al. (2017) Making the Difference: Breaking the link between school exclusion and social exclusion, Institute for Public Policy Research

[8] Poulton, Moffitt, & Silva (2015). The Dunedin Multidisciplinary Health and Development Study overview of the first 40 years, with an eye to the future. Social Psychiatry.

childhood backgrounds. This ongoing research has reported substantial findings over the years. Notably, **22% of this cohort were reported to account for a significant amount of the cohort's adult social ills by age 38**; this high-cost group accounted for 81% of the cohort's crimes, were responsible for 77% of fatherless child-rearing for the cohort's next generation, used 66% of welfare benefits, smoked 54% of the cohort's tobacco cigarettes, carried 40% of the cohort's overweight kilograms, occupied 57% of hospital bed-nights, were prescribed 78% of prescriptions, and claimed 36% of the cohort's insurance costs to the state.[9] This group were also reported to have lower cognitive functioning at age 3.[10][11] This research strongly suggests that **brain functioning in early childhood years has strong associations with negative adult social behaviours**. If the promotion of education breaks negative cycles and encourages social mobility, interventions in early-education may then promote positive behaviours and reduce the risk of children "switching-off" from education.

2.2 Previous use of BrainHQ in the literature

Often cognitive brain training programmes fail to translate into real-world applications, with meta-reviews detailing that while performance on the test tasks might improve, these tests often fail to translate into improved performance in real-world settings.[12] However, the research also suggests that brain training programs which target neuroplasticity might show greater improvements in everyday functioning.

Stronger Brains has co-developed assessments and exercises with Posit Science (i.e. BrainHQ).[13] Research has found the **BrainHQ programme to be employed in more gold-standard Randomised Controlled Trials (RCT) than other market competitors** in healthy adults and clinical patient populations (Lin 2016; Shah et al., 2017). **Tasks specifically designed for children from the BrainHQ programme**, similar to the Stronger Brains tasks, **have been tested in clinical child populations**, such as looking at the effects of genetic

[9] Caspi et al. (2016). Childhood forecasting of a small segment of the population with large economic burden. Nature Human Behaviour.

[10] https://www.sciencemag.org/news/2018/02/two-psychologists-followed-1000-new-zealanders-decades-here-s-what-they-found-about-how

[11] Richmond-Rakerd et al. (2020). Clustering of health, crime and social-welfare inequality in 4 million citizens from two nations. Nature Human Behaviour.

[12] Van Heugten, Ponds & Kessels (2016). Brain training: hype or hope? Neuropsychological Rehabilitation;
Kelly, Loughrey, Lawlor, Robertson, Walsh, & Brennan (2014). The impact of cognitive training and mental stimulation on cognitive everyday functioning of healthy older adults: A systematic review and meta-analysis. Ageing Research Reviews.

[13] https://www.brainhq.com/

disorders[14] and adolescent polydrug use[15], where it has shown improvements in some children.

Children with the developmental disorder chromosome 22q11.2 deletion syndrome (which often present high rates of psychiatry disorders and cognitive impairment) were randomised to a BrainHQ training programme intervention or a control trial. The 12-week self-administered training programme contained eight tasks designed for children with cognitive difficulties. The tasks targeted visual attention (Pet Wrangler and Speed Trap), processing speed (Test Driver and Navigator), and verbal attention (Coffee Break, Stage Crew, Brain Blog, and Audio Mash-Up). The training programme required children to play three tasks per session, at four times a week over the 12 weeks. The treatment group showed improvement on the composite training programme score from baseline to follow-up compared to the control group.

Conversely, adolescents with histories of polydrug use were placed on a BrainHQ attention training programme intervention. The BrainHQ task, "Focus my attention" task that measures sustained and selective attention) showed significantly slower reaction times (at baseline and follow-up) compared to those control group adolescents with no history of polydrug use who showed improvement in reaction time speeds from baseline to follow-up. **However, the BrainHQ programme's efficacy is yet to be established in a sample of primary school children outside of a clinical trial.**

2.3 Mentoring

When researching a student's cognitive performance, other factors may be at play, such as the child's motivation to the cognitive training programme and whether the child is extrinsically or intrinsically motivated to do well (Jaeggi et al. 2013). Seldom are children extrinsically motivated to engage with cognitive training programmes, as they often find the cognitive training tasks "too difficult and effortful", resulting in disengagement with learning and lower cognitive performance (Jaeggi et al. 2011). Unfortunately, these intervention programmes often fail to account for mentoring support to extrinsically encourage children to engage with their learning and cognitive development. However, we note that extrinsic motivation can be established by praising effort and intrinsic motivation could be facilitated over time through mentoring discussions.

The Mentoring Effect Report (2014)[16] shows at risk youth with long-term mentors more likely to display positive social behaviours (e.g. attending higher education, participating in social

[14] Harrell et al. (2013). Feasibility and Preliminary Efficacy Data from a Computerized Cognitive Intervention in Children with Chromosome 22q11.2 Deletion Syndrome. Research in Developmental Disabilities.

[15] Diaz Baquero & Camelo Rao (2019). Brain Electrical activity of attention in polydrug adolescents using an equipment BCI (Brain Control Interface). Acta Colombiana de Psicologia.

[16] https://www.mentoring.org/images/uploads/Report_TheMentoringEffect.pdf

sports, holding leadership positions, and volunteering). Satisfaction with their mentors doubled for those children who had maintained a relationship with their mentor for more than a year with these children presenting more positive social behaviours than those who knew their mentor for less than a year. This strongly suggests that **the longer mentor relationship, the more successful the mentor relationship is**. Similar mentoring effects can be seen with adult intervention programmes. Research by Mohr, Cujpers and Lehman (2011) shows **adherence to online intervention programmes in adults increases with support from a trusting and experienced mentor**; however, this research did not investigate online programmes with children.

2.4 Children's wellbeing

Often overlooked in children, wellbeing is a multi-faceted concept,[17] and in this study, was considered to be made up of physical, social and mental health. Physical activity is shown to play a large role in children's overall health and wellbeing. **In children of 8 to 12 years, physical activity was shown to be positively correlated to children's wellbeing**, as reported by parents and self-reported by the child (Holder et al. 2009). Conversely, leisure activity (inactive) was negatively correlated to children's wellbeing (Holder et al. 2009). However, physical activity should also be considered alongside children's diet and nutrition.

Poor diet and nutrition are linked to societal ill-health and large Exchequer costs in public health, with lower socio-economic groups showing inequalities in physical activity and diet. Higher Body Mass Index (BMI) and obesity are prevalent in lower socioeconomic status groups for both children and adults, with longitudinal studies finding **childhood obesity and high BMI persistent throughout the lifetime**.[18] Alongside this, lower socioeconomic status in childhood was found to result in larger differences in social class inequalities found later in life, suggesting a continuing cycle across generations. Childhood obesity and higher BMI are linked to physical health issues, lower self-esteem, poor academic performance, lower quality of life, and poorer social and emotional wellbeing in the short-term.[19] However, we note the complexity in the direction of the relationship between higher BMI and mental health, with low self-esteem, and potentially obesity stigma, impacting on children's diet and nutrition.[20]

Broadly speaking, poor emotional wellbeing refers to mental disorders such as separation anxiety, phobias, hyperactivity, conduct problems, anxiety disorders and depression. Poor emotional wellbeing is known to negatively impact children's behaviour, as **children with**

[17] Dolan & Fujiwara (2016). Happiness-Based Policy Analysis. The Oxford Handbook of Well-Being and Public Policy.
[18] Bann, Johnson, Li, Kuh & Hardy (2017). Socioeconomic Inequalities in Body Mass Index across Adulthood: Coordinated Analyses of Individual Participant Data from Three British Birth Cohort Studies Iniated in 1946, 1958 and 1970. PLoS Medicine.
[19] Sahoo, Sahoo, Kumar Choudhury, Yasin Sofi, Jumar & Singh Bhadoria (2015). Childhood obesity: causes and consequences. Journal of Family Medicine and Primary Care.
[20] Gifford Sawyer, Harchak, Wake, & Lynch (2011). Four-Year Prospective Study of BMI and Mental Health Problems in Young Children. Pediatrics.

poorer emotional wellbeing or mental disorders are more likely to be excluded or absent from school, exhibit poorer cognitive functioning and development than that of their peers and become 'switched off' from education.[21] While the relationship between later academic achievement and emotional wellbeing is debated, poor emotional wellbeing is likely to impact other areas of a child's immediate functioning and wellbeing, such as social wellbeing.[22]

Social wellbeing with peers can have both positive and negative effects on development in youth, particularly with bullying. Bullying perpetrators and victims of bullying have been shown to report long-term negative health impacts. Negative socialisation with peers, including bullying, can promote antisocial behaviour, substance abuse, sexual risk-taking behaviour, violence, poor psychological health, and criminal activity.[23] Conversely, **quality social interactions with peers can have direct positive impacts on long-term social and psychological outcomes** and in turn, reduce school exclusion and absenteeism.

Educational achievements and cognitive abilities are a primary social determinant of a young person's health and wellbeing. Greater educational achievements have been associated the better the short- and long-term health outcomes.[24] For instance, educational qualifications have been thought to shape later employment options. Additionally, educational qualifications are associated with increased health literacy, helping to form better decisions in physical and mental health. Higher educational attainment has been shown to improve self-esteem, social support, civic participation, income equality, and improved health outcome, such as better self-reported health, lower BMI, and healthier habits later in life.

Early intervention could seek to disengage the cycle of the negative impacts of school exclusion in children, which later develops into negative adult social behaviours and costly welfare issues, as shown in the literature.[25] If proven effective, based on the current literature, Project HE:RO and associated programmes would have substantial societal impact over the long term.

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[21] Morrison Gutman & Vorhaus (2012). The Impact of Pupil Behaviour and Wellbeing on Educational Outcomes. Department for Education.

[22] Hagell et al. (2018). The social determinants of young people's health: Identifying the key issues and assessing how young people are doing in the 2010s. Health Foundation Working Paper.

[23] Hagell et al. (2018)

[24] Hagell et al. (2018)

[25] Richmond-Rakerd et al. (2020). Clustering of health, crime and social-welfare inequality in 4 million citizens from two nations. Nature Human Behaviour.

3 Data and methodology

3.1 Sample

While Project HE:RO is offered in England and Wales, this data is focused on pupils in primary schools within England only. Data was collected in 2018–2019 during school semesters for year 4 to year 6 pupils (8-11 years old).[26] Project HE:RO is the focus of this report, but the programme was offered alongside Engine Room in one of the schools. Table 3-1 provides an overview of the Project HE:RO and Engine Room programmes.

Table 3-1 Evolve's Project HE:RO and Engine Room programmes

	Control Schools	Treatment Schools		
	Untreated	Untreated	Project HE:RO	Engine Room
Activity	No Health Mentor	General Health Mentor activities	Weekly mentoring session	Daily Brain Training games
Programme length	*No programme*		Year long	Term long
Schools	Parkgate Queen Emma's St. Peters	Blakesley Hall, Frizinghall, Old Bank, Rosslyn Park, St. Augustine's, St. Wilfrid's, Seven Sisters		Seven Sisters
Age	Year 4 to 6 (8 to 11 years old)			
Wellbeing data	Wellbeing Compass (Baseline, End of Term 1, End of Term 2, End of Term 3)			
Cognitive data	None	Stronger Brains (During Term 2, End of Term 3)		
Cohort size	251	863	132	11

Note that 3 pupils took part in both Engine Room and Project HE:RO due to the difference in selection criteria. See section 3.3 for more detail.

For each pupil, we collected information on their school year, class group, and gender. All appropriate consents were secured prior to data collection. Plans were formulated to obtain information from educational software 'Groupcall XoD', such as school attendance records, negative behaviour, and academic progress throughout the semesters reported by teachers and education staff. It was not possible to secure this data for the completion of this report.

More information about the schools is available in annex 6.1.

3.2 Wellbeing Compass and Stronger Brains

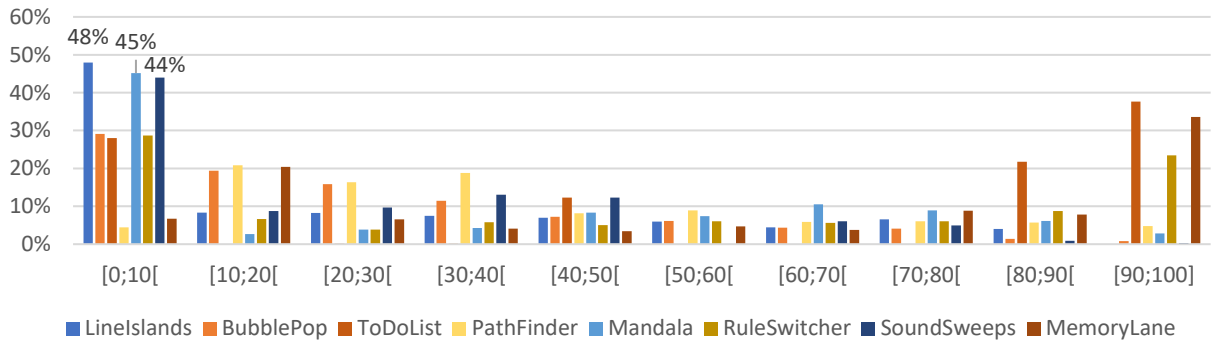
While the BrainHQ programme has been used extensively in the adult population (Shah et al., 2017; Lin 2016), Stronger Brains is yet to be validated in a child population.

[26] We excluded any respondent below year 4 from analysis due to low sample size

In this report, we analyse Stronger Brains both as a global composite score and by each individual exercise, given that grouping together brain training tasks may oversimplify the findings. For example, short-term memory and working memory, while both employing memory processes, arguably measure different memory systems. Whilst short-term memory tasks employ only short-term memory processes, working memory tasks also require 'updating' systems (Friedman, et al. 2006)[27]. In this intervention, the Stronger Brains exercises were *Line Islands, Bubble Pop, To Do List, Path Finder, Mandala, Rule Switcher, Sound Sweeps,* and *Memory Lane*. These exercises are described in Annex 6.2.

Stronger Brains scores are reported in percentiles. They tell you how the pupil scored compared to the pool of others who took the exercises. Note that the Stronger Brains reference sample of respondents that have completed these tasks is largely an adult population. It is important to note that on three cognitive tasks (Line Islands, Mandala, and Sound Sweeps) we did observe a large proportion (44-48%) of pupils that scored in the lowest percentile (0-10%) compared to the Stronger Brains reference sample (see Figure 3-1). This suggests that either those exercises might not be practical for children or that ranking pupils' cognition based on adults' scores is inappropriate. Further research is required. For this report and in absence of additional evidence, we decided to include all exercises in the analysis.

Figure 3-1 Distribution of Stronger Brains scores by cognitive task



Wellbeing Compass is a survey completed by pupils. It records children's wellbeing across five domains: physical activity, diet and nutrition, personal wellbeing, emotional development, and cognitive functioning. The full survey can be found in annex 6.3. Each question was then encoded to a score from 1 to 5, where 5 is the most desirable answer.

These five domains of wellbeing can be considered together to form a global wellbeing score.

[27] Friedman et al. (2016) Not All Executive Functions Are Related to Intelligence

Validation of the scales

The Wellbeing Compass is currently being validated by Professor Jim McKenna and researchers at Leeds Beckett University.

In the development of this scale, physical activity is to be compared against physical activity recorded from the study. No validated scale, which was sufficiently short enough for children to answer, was found to compare the results obtained under the 'diet and nutrition' domain. Emotional wellbeing is to be compared against the Kiddy-KINDL 6 subscale questionnaire.[28] Personal development is to be compared against the Student Life Satisfaction Scale.[29] Cognitive function is to be compared against the Stronger Brains data from the study.

As a result, we interpret the Stronger Brains domains and Wellbeing Compass Scale with caution and acknowledge this caveat.

3.3 The programme

3.3.1 Project HE:RO

Wellbeing Compass was used to determine the 'at risk' pupils alongside teacher reports on their behaviour inside and outside of the classroom (see Table 3-2). The children recruited were selected based on their behavioural needs or issues with self-confidence and resilience, and not necessarily their cognitive abilities. The aim was to recruit 20-25 students per school which were in the lowest percentile (10%) of wellbeing or recommended by staff due to their behaviour.

Table 3-2 Health mentor information and selection criteria for each school

School	Health mentor gender	Days per week in school	Selection criteria for mentoring
Seven Sisters	<male>	5 days	Wellbeing Compass & school observations
Blakesley Hall	<male>	5 days	School observations
St Wilfrid's	<male>	5 days	Wellbeing Compass
Old Bank	<male>	1 day	Wellbeing Compass & school observations
Frizinghall	<male>	3 days	Wellbeing Compass & school observations
St Augustines	<male>	3 days	School observations
Rosslyn Park	<male>	5 days	Wellbeing Compass

[28] Ravens-Sieberer, U. & Bullinger, M. (1998a). Assessing health related quality of life in chronically ill children with the German KINDL: first psychometric and content-analytical results. Quality of Life Research, Vol. 4, No 7

[29] Huebner, E. S. (1991). Further validation of the students' life satisfaction scale: The independence of satisfaction and affect ratings. Journal of Psychoeducational Assessment, 9, 363-368.

One Health Mentor was assigned to each school and were present throughout the school week, with the Health Mentor staying with the same year per day (e.g. Year 6). This ensures rapport can be established between the pupils and the Health Mentor.

In the beginning of the semester, any afternoon mentoring activities are often completed one-on-one to ensure that the Health Mentor provides adequate attention to each child in the early stages. As the semester progresses, groups of up to six students can successfully participate in one mentor session together. This system allows for more children to be added to the programme as the semester progresses.

Table 3-2 details the frequency of Health Mentor days in each school. Rapport between students and mentors was established through ongoing daily activities during the week. This ensured stronger treatment effects, through the presence of the mentor across different environments with the children, as suggested by prior research.[30] Project HE:RO and Engine Room sessions were conducted in the afternoons, as described in the example timetable presented in Table 3-3.[31]

Table 3-3 An example of one Health Mentor's timetable

Day	Before School – Breakfast Club (30 minutes)	AM Registration (15 minutes)	AM 1	AM 2	Lunch	PM 1	PM 2	After School Club (60 minutes)
Monday	Reading (Year 6)	Classroom movers (all years)	Classroom coaching (Year 6)	Classroom coaching (Year 6)	Playground activities (all years)	Mentoring (Year 6)	Mentoring (Year 6)	Arts and Crafts (Year 6)
Tuesday	Cricket (Year 5)	Classroom movers (all years)	Classroom coaching (Year 5)	Classroom coaching (Year 5)	Playground activities (all years)	Mentoring (Year 5)	Mentoring (Year 5)	Physical activity (Year 5)
Wednesday	School Assembly Prep (All years)	Classroom movers (all years)	Classroom coaching (Year 5)	Classroom coaching (Year 6)	Playground activities (all years)	Mentoring (Year 5)	Mentoring (Year 6)	Homework (Year 5 & 6)
Thursday	Walking Bus (Year 3)	Classroom movers (all years)	Classroom coaching (Year 3)	Classroom coaching (Year 3)	Playground activities (all years)	Mentoring (Year 3)	Mentoring (Year 3)	Computing (Year 3)
Friday	Arts and Crafts (Year 4)	Classroom movers (all years)	Classroom coaching (Year 4)	Classroom coaching (Year 4)	Playground activities (all years)	Mentoring (Year 4)	Mentoring (Year 4)	Physical Activity (Year 4)

3.3.2 Engine Room

During Term 2 (between January and March 2019), scores from the eight tasks in Stronger Brains were used to recruit the pupils in the Engine Room programme. Children for this programme were recruited based on their lower cognitive scores. These scores were checked with teachers to establish student behaviour (e.g. low attainment history, special

[30] https://www.mentoring.org/images/uploads/Report_TheMentoringEffect.pdf

[31] Albeit, three of the seven schools did not record what time assessment was undertaken.

education needs) to ensure that any children who performed poorly on testing day were not mistakenly taken into the programme.

The Engine Room treatment programme was administered for three hours a day, five days per week for twelve weeks from March to May 2019 at one school (Seven Sisters). The programme involved the administration of brain training activities (Stronger Brains task set), and a self-report survey designed to record children's wellbeing across several domains (Wellbeing Compass). The same eight Stronger Brains tasks were administered during the intervention programme in a quiet classroom specifically for the programme. The Stronger Brains programme tasks are further detailed in section 6.2. The intervention was administered every school day in the afternoon (e.g. from 1:30pm to 3:30pm) in a quiet classroom. Students completed the cognitive tasks on a computer or a tablet (e.g. iPad) in a quiet room specifically for the Project HE:RO with the latest Adobe Flash Player with headphones. For each task, video instructions were provided. Practice rounds were presented before each activity to ensure participants understood the task instructions. The same task set was used across time intervals (refer to Table 6-2), however the order of the task set was different each time. The task difficulty increased as students progressed through the task levels. Each time a final composite percentile score was calculated for the Stronger Brains task set. Mentors were instructed to praise effort not achievement and told students that there were no 'right' or 'wrong' answers. Students were reminded by mentors that they could press full screen to make it easier to see each activity. If students were appearing frustrated with the task, mentors were instructed to pause the exercise, explain why they were doing this, re-watch the video instructions and encourage students to take three mindful breaths.

3.4 Models

As is often the case when estimating causal relationships, the ideal scenario of running a Randomized Controlled Trial (RCT) – whereby participants would randomly be allocated into the programme – runs into practical and ethical considerations which render it unfeasible.

Where RCT cannot be employed, best-practice dictates that a quasi-experimental method should be employed instead. Quasi-experimental methods attempt to replicate as closely as possible the mechanics of an experiment but without the need for random assignment of the intervention. They can be used retrospectively and applied to projects that have already been completed. There are a large range of methods that sit within this category of methodology and there are different degrees of rigour involved. The commonality in quasi-experimental methods is the process of controlling for other factors. These methods try and control for (i.e., exclude) all other influences that may be explaining any changes in outcomes that are observed. If all the other potential influences can be controlled for, then the quasi-experiment will be robust. However, the ability to control for all other possible factors is rare and hence quasi-experimental methods tend to be at more risk of bias than experiments.

3.4.1 Wellbeing model

One of the most rigorous quasi-experimental methods is regression analysis using Fixed Effect models.

Our dataset by tracking the same individuals over time allows to control for unobserved time-invariant individual fixed effects. Such effects may include personality or motivation, which are undoubtedly correlated with wellbeing. In fixed effects estimation, one is only comparing the changes over time for the same individual that occur for wellbeing, the programme and the control variables with the aim of modelling a linear relationship among these.

Fixed Effect (FE) is even more appropriate here due to the limited availability of control variables. We've also explored Ordinary Least Squares (OLS) and Random Effect (RE) models which gave fairly similar results. Following common practice in the wellbeing literature, we use fixed-effect models. Additional models, such as OLS and RE are presented in annex 6.4.1 for robustness.

In addition to accounting for individual fixed-effects, we account for the time trend and for the potential for spill-overs. By spill-overs, we mean the effect of the presence of health mentors in a school has on pupils which are not directly taking part in the programme themselves (engaging with the health mentor at school clubs, etc.).

The starting point of our analysis is given by the following model:

$$Outcome_{it} = \sum_{t=1}^{T=3} \beta_t Period_t + \sum_{t=1}^{T=3} \gamma_t (Treated_i \cdot Period_t) + \sum_{t=1}^{T=3} \gamma_t (Spillover_i \cdot Period_t) + \alpha_i + \varepsilon_{it}$$

where $Outcome_{it}$ is the outcome for individual i at time t; $Period_t$ is the current school term; $Treated_i \cdot Period_t$ identifies those taking part in the programme at time t; $Spillover_i \cdot Period_t$ identifies those not taking part in the programme but in a school with a health mentor at time t; α_i are the individual fixed effects; and ε_{it} is the error term.

We then explored disaggregated effects where we explored if the potential treatment was associated with:

- The number of days the health mentor was in school each week
- The selection criteria used in the school for enrolment into the programme

3.4.2 Cognitive model

For the purpose of analysing the cognitive data, due to its availability only in treated schools, its measurement mostly at 2 points in time (baseline and at the end of the 3rd term), we cannot explore the potential impact of the programme on cognitive health. However, using

regression analysis based on an OLS model, controlling for time period, gender and year group, **we investigated the potential interaction between wellbeing and brain health.**

Due to the preliminary nature of this analysis, we only report results on the composite Stronger Brains score in the main results. Additional results for each cognitive exercise can be found in annex 6.4.2.

4 Results

4.1 Descriptives

Terminology

Three schools which have not been taking part in the programme have accepted to participate in the study, these form our Control schools.

We note that we also have a group (~70% of our sample) of pupils which are in the schools where Project HE:RO is currently ongoing, but these pupils are not receiving mentoring sessions (i.e. Schoolmates not in the programme).

Through the rest of this report, we will refer to the 'Control schools' group and the 'Schoolmates not in the programme' group as defined above.

Caveat around Engine Room results

Again, we caveat our findings with the small sample size (n = 11) for the Engine Room programme. This programme was offered for twelve weeks from March to May 2019 in one school. Stronger Brain scores were assessed during Term 2 (between January and March 2019) and after the end of Term 3 (in July or October 2019). Results for this group should only be interpreted accordingly.

4.1.1 Wellbeing

We first look at the change in scores for each wellbeing component among the four groups (Project HE:RO, Engine Room, and control groups) before and after the intervention.

Figure 4-1 shows that wellbeing measures are quite stable over time for those not taking part in the programme (both Control schools and Schoolmates not in the programme) as we cannot discern any visible difference in their scores at the beginning and the end of the school year.

This accords with our prior theoretical expectation, given we would expect the wellbeing of the control group to be stable over time as they did not receive any intervention.

The key finding is that among Project HE:RO participants, we can see improvements over time across all Wellbeing Compass dimensions: Physical activity, Diet and nutrition, Personal development, Emotional wellbeing and Cognitive functioning.

We observe contradictory evidence for the participants of Engine Room, with a small improvement in Physical activity and a decrease in all 4 other dimensions, but we note that the small sample (*n* = 11) would prevent us to draw any meaningful conclusions. We note that the Engine Room programme runs for a shorter period of time than Project HE:RO, wherein improvements in Wellbeing Compass scores are typically witnessed by Evolve in previous years after 24 weeks of mentoring. We display further results throughout section 4.1 for Engine Room for completeness, acknowledging these limitations.

Figure 4-1 Wellbeing scores of pupils by category

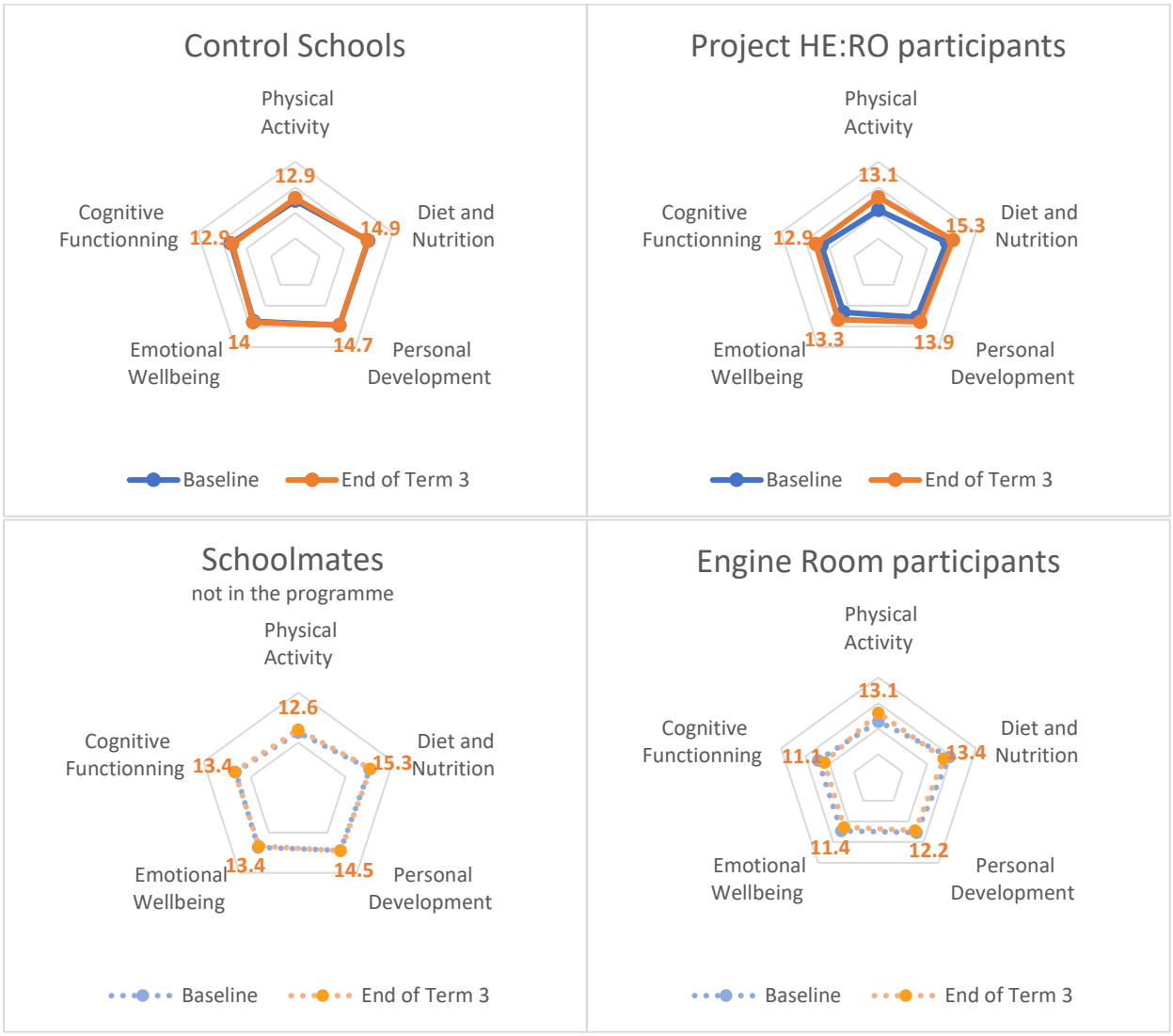
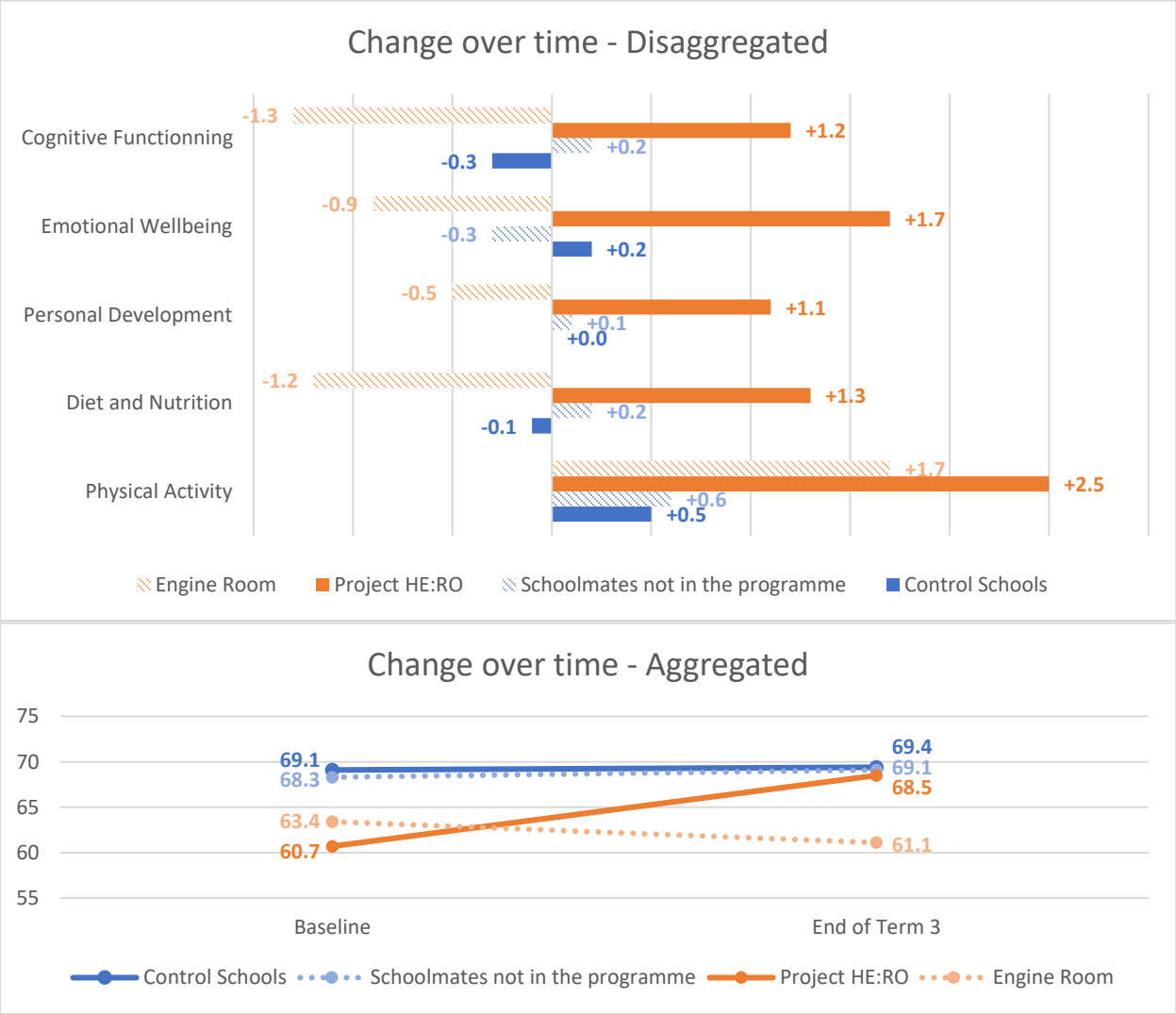


Figure 4-2 shows the extent to which participants in Project HE:RO have experienced an increase in their wellbeing scores over time. Both control groups showed rather stable scores

over time. An increase in wellbeing score by 1 would signify that, on average, each participant selected the next most desirable option compared to their previous choice when answering the Wellbeing Compass questionnaire (for example, on the school enjoyment question, if they had picked the 3rd option, "I enjoy school a lot of the time" at the beginning of the year, they now picked the 4th option "I enjoy school most of the time"). Across the sample average, any increase/decrease of less than one would signify that the increase/decrease is not happening for everyone or that individual changes are too small to be visible/captured by the current scale.

Figure 4-2 Wellbeing change over time



Project HE:RO participants have shown sizable improvements in average wellbeing scores overall and within each dimension (Physical activity, Diet and nutrition, Personal development, Emotional wellbeing and Cognitive functioning) throughout the year.

For the 11 participants in **Engine Room** we observe contradicting evidence with their wellbeing decreasing over time in 4 of the 5 wellbeing categories. Although this suggests a decrease in the wellbeing of Engine Room participants over time, we note that this finding may be driven by the small sample and the potential for other external factors that drive changes in wellbeing outcomes, rather than the programme itself. Due to the small sample size, we were unable to include Engine Room it in the regression analysis in Section 4.2. We do note, however, an increase in physical activity over the course of the programme which coincides with the qualitative evidence that was observed on-site by the health mentor (refer to Annex 6.5).

In summary, Project HE:RO has shown to have a strong positive impact on wellbeing through all five of its components. In contrast, Engine Room has not shown a clear improvement in wellbeing over time and would require further research with larger sample size.

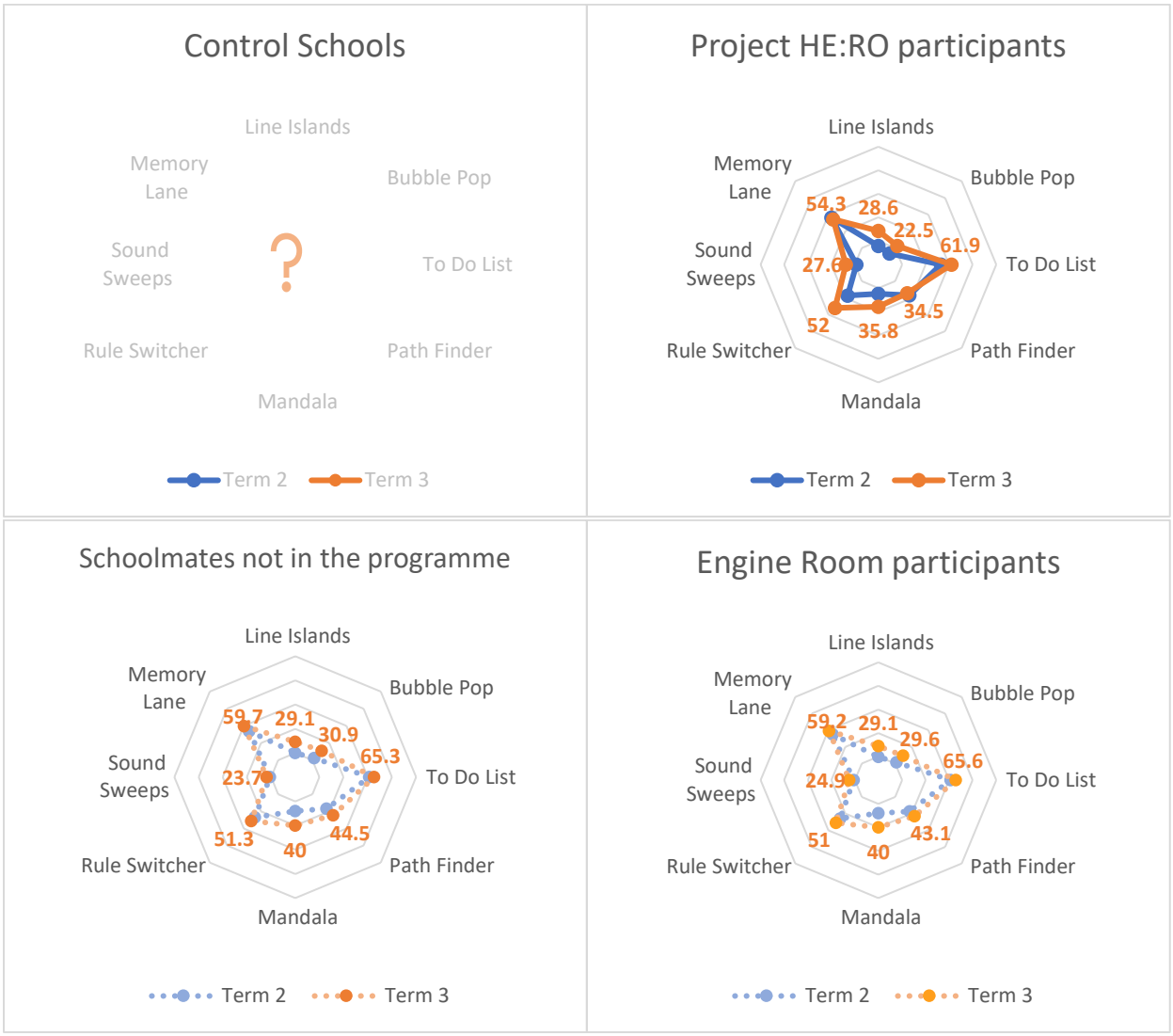
4.1.2 Brain Health

We then look at the change in brain health through students' scorings in eight Stronger Brains cognitive exercises: Bubble Pop, Line Islands, To Do List, Path Finder, Mandala, Rule Switcher, Sound Sweeps, and Memory Lane. Figure 4-3 shows increase over time on most cognitive tasks for all groups (Project HE:RO, Engine Room, and Schoolmates not in the programme) when comparing scores measured during the second term (Jan-March 2019) with the end of year (July and October 2019). The Control schools did not complete Stronger Brains testing, so we cannot report counterfactual data here.

Stronger Brains scores are defined in such that a score above 50 means the respondent is performing better than the average Stronger Brains past users; conversely, a score below 50 means the respondent performed worth than the average Stronger Brains past users. Due to the low sample size of children who used the tool previously, the scores used in this study are based on an average adult performance which might not be appropriate. Refer back to section 3.2 for a further discussion of the limitations of using Stronger Brains with pupils.

A consistent pattern in scores on the cognitive tasks was observed across the pupil groups. The To Do List task and the Memory Lane task consistently scored the highest amongst the cognitive tasks while Sound Sweeps, Line Islands and Bubble Pop scored the lowest.

Figure 4-3 Brain health scores of pupils by category



The consistent low scores in some of the exercises (Sound Sweeps, Line Islands, Bubble Pop) suggest that either;

- **These exercises are more difficult for children and might need to be adapted, or**
- **Rating child scores based on adult population is inappropriate and further research is required to produce children-appropriate scores.**

For future research, we suggest exploring and testing the appropriateness of the current selection of exercises. We suggest exploring the use of other exercises and exploring modification of the current ones to ensure tasks are children appropriate. Recall (as presented in Figure 3-1) that **three exercises (Line Islands, Mandala and Sound Sweeps)**

had more than 40% of pupils with scores between 0 and 10 which we interpret as pupils not understanding the tasks[32].

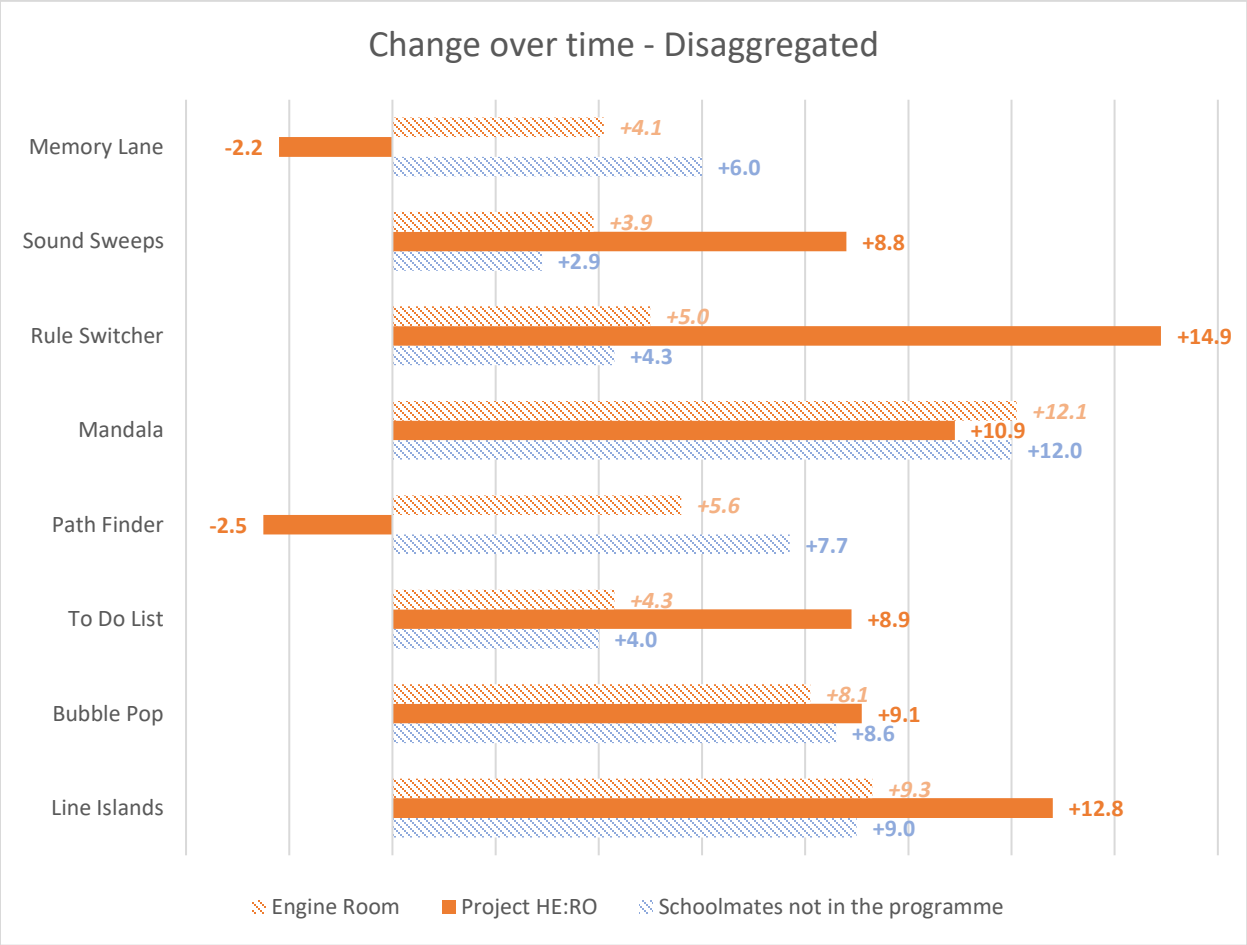
Path Finder and Memory Lane scores decreased over time for Project HE:RO pupils. The Memory Lane task requiring remember the path from the Path Finder task earlier in the testing session, failing one would induce a lower score to the other. These small decreases are the smallest changes across all cognitive tasks and across all study groups, we therefore do not consider them to be too much of a concern and think that this decrease over time might only be due to high initial test scores. We do not expect the programme to have a negative effect on brain health. **We therefore suggest that more data is collected prior to making any meaningful conclusions based on this test data.**

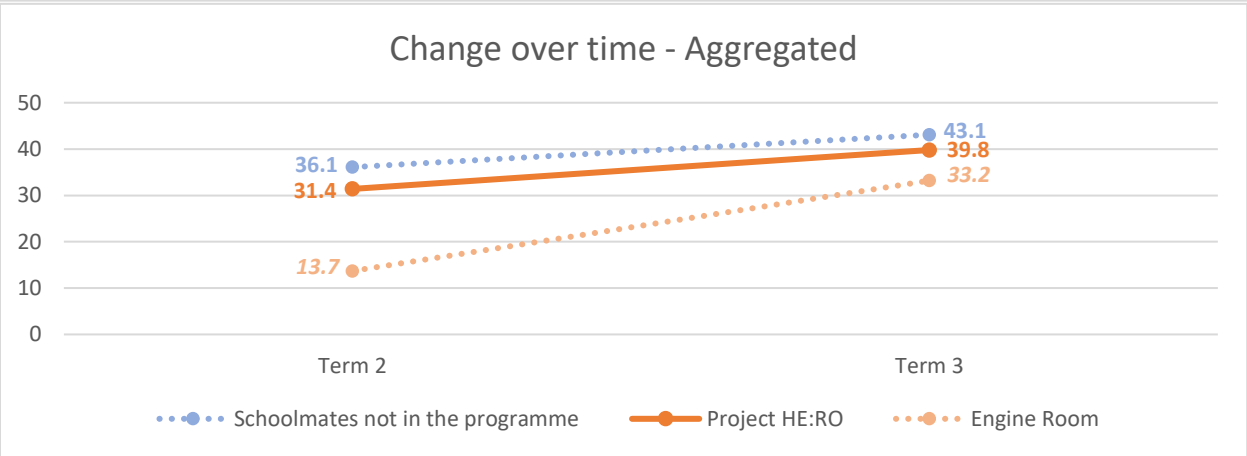
Project HE:RO participants have shown strong improvements on all six other cognitive tasks. Something worthy of note is the **improvement on the Rule Switcher task of Project HE:RO participants is considerably higher compared to the other reference groups of Schoolmates not in the programme or Engine Room participants.** This Rule Switcher task measures executive functioning crucial for following rules and decision-making. In the Health Mentor interview (refer to annex 6.3), the mentor described how pupils of the Project HE:RO programme were given rules (e.g. if you want to play games to show respect and make sure no one was left out). **If Project HE:RO pupils were practising following rules throughout the semester, it is not surprising that these skills translated across onto the Rule Switcher task.**

Engine Room pupils, who practiced the cognitive tasks throughout the semester, showed **similar improvement to that of the control group on each individual cognitive task**. The fact that pupils with learning impairment were able to perform as well as any other pupils **suggests the success of the intervention.**

[32] We suggest that research is undertaken to evaluate the comparability of adult and children performance and therefore the appropriateness of using the same scores.

Figure 4-4 Brain health changes over time





Looking at the aggregated scores over time, we see that the Project HE:RO participants and their Schoolmates not in the programme follow the same upward trend. However, rather than suggesting no impact from the programme, we believe this to be driven by the fact that:

- **Schoolmates not in the programme are not an appropriate control** as, by design, we know they would not have been selected into the programme. We expect them to be different from pupils enrolled in Project HE:RO
- As we explore further in section 4.2.1, there are potential wider 'spillover' effects of the programme on other pupils in the school (i.e. unintended positive impacts on others than the participants) and therefore **the increase in brain health observed for the Schoolmates not in the programme might be partly due to the intervention** and not have happened anyway.

For Engine Room, pupils did show the steepest improvement over the intervention period. However, there is no reference group for direct comparison on these scores. Project HE:RO pupils and the Schoolmates not in the programme did not practice the cognitive tasks on a daily basis over the semester. **It would be appropriate for future research to survey a control group of pupils performing the cognitive exercises on a more regular basis than once per term to disentangle the effect of the exercises on brain health and the simple learning effect due to the repetition of the exercises.**

Stronger Brains Measurement error

Around 26% of the sample did not complete one or more of the 8 Stronger Brains exercises. Our composite score represents an average of the completed exercises scores. The distribution of tasks completed within the sample shows that only 74% of the time respondents have completed all 8 tasks. The rest of the time our score might an average of 1, 2 or 5 exercises only. This measurement error might bias our results and is one the limitations of this study which should be improved on if this research was to be expanded on.

4.2 Regression analysis

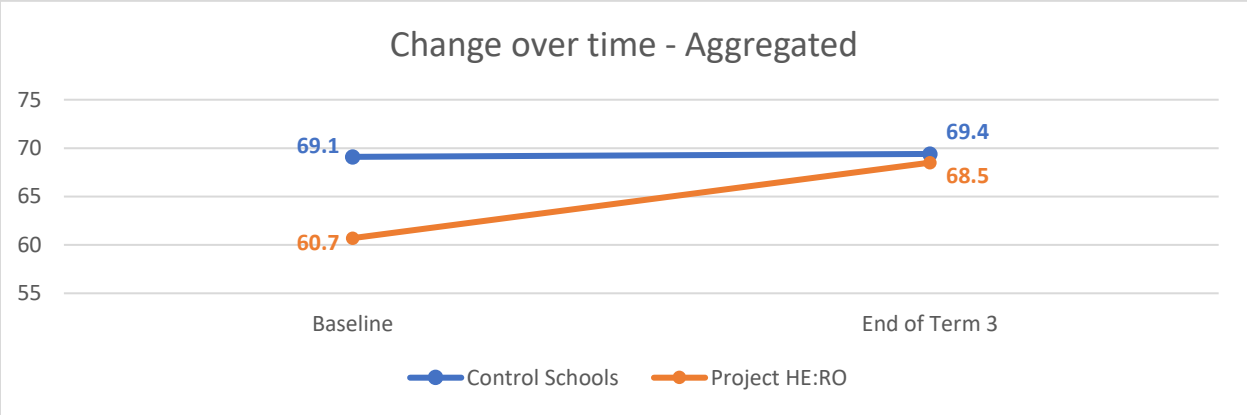
4.2.1 Wellbeing Compass

Using regression analysis, **we try to understand how much any improvements in wellbeing reported by Project HE:RO participants is attributable to the intervention**.

We use a fixed effect model. Fixed effect analysis controls for factors that do not change over time (e.g., personality trait, gender, etc.) on wellbeing are fixed over time. The analysis is then able to focus on those factors that can drive wellbeing, and which are changeable over time. This removes the confounding effect of any unobservable time-invariant factors, which strengthens the causal estimate.

First, we compare wellbeing levels at baseline, before the programme started. At baseline, pupils who were selected into Project HE:RO had on average a wellbeing scores 8.4 points lower than the control group (60.7 compared to 69.1, see Figure 4-5 below). This is in line with our prior expectations that the programme would be targeted at those pupils most in need of it, and who would by extension suffer from lower wellbeing levels.

Figure 4-5 Wellbeing change over time



The fixed effect model analyses the effect of the programme over time, showing that throughout the year, **the pupils enrolled in Project HE:RO began to catch up with their control group peers in other schools or with their Schoolmates who were not on the programme**. By the end of term 2, the gap is nearly closed, with an increase in wellbeing of +7.4 (on a scale of 20-100) within the treatment group compared to the control group (see Table 4-1 below)**. By the end of the third school term, the wellbeing gap is entirely closed, and we see that participants are as happy as their peers with an average increase in wellbeing of +9.7** (on a scale of 20-100)**.**

One surprising result is the negative trend in wellbeing of the Control schools over time (-1.25). We note that this is however small and significant only at the 90% confidence level.

We also observed an increase in wellbeing for Schoolmates of project HE:RO participants not in the programme (+1.9) **which suggests** that potential spill-over effects are present (i.e. unintended positive impacts on others than the participants). This suggests that the programme brings **wider benefits to the rest of the school and not only to the programme participants**.

Table 4-1 Wellbeing overall impact

	Project HE:RO
End of Term 1	-0.775
End of Term 2	-0.684
End of Term 3	-1.253*
Project HE:RO # End of Term 1	**3.284****
Project HE:RO # End of Term 2	**7.438*****
Project HE:RO # End of Term 3	**9.725*****
Schoolmates # End of Term 1	1.638*
Schoolmates # End of Term 2	0.644

Schoolmates # End of Term 3	**1.961****
Constant	67.73***
N	3047
Model	FE
R-sq (within)	0.0583
R-sq (between)	0.000532
R-sq (overall)	0.00857
* p<0.10, ** p<0.05, *** p<0.01	

Notes. This model is compared to OLS and RE in annex 6.4.1. We found similar results

We explored how the programme performs depending on how participants were chosen. The programme performs best in schools which used Wellbeing Compass as one of their selection criteria for identifying at risk pupils:

- Schools that did not use Wellbeing Compass to decide who should enrol in the programme saw an average increase in wellbeing among programme participants of +3.347 (on a scale of 20-100)
- Schools that used a mix of staff recommendation and Wellbeing Compass saw an increase of +9.765 (=6.418+3.347, on a scale of 20-100)
- Those who used only Wellbeing Compass saw the largest increase of +14.507 (=11.16+3.347, on a scale of 20-100).

In sum, schools which use Wellbeing Compass as a criterion for enrolling in the programme see an increase in wellbeing scores 2 to 3 times higher than those who do not.

Table 4-2 Wellbeing impact by selection criteria

	Project HE:RO
End of Term 1	1.459**
End of Term 2	-0.447
End of Term 3	1.315
Project HE:RO # End of Term 1	-0.118
Project HE:RO # End of Term 2	3.285*
Project HE:RO # End of Term 3	**3.347****
End of Term 1 # Control	-2.235*
End of Term 1 # Wellbeing Compass	-0.315
End of Term 1 # Mixed criteria	-1.343
End of Term 2 # Control	-0.238
End of Term 2 # Wellbeing Compass	1.473

End of Term 2 # Mixed criteria	0.297
End of Term 3 # Control	-2.568**
End of Term 3 # Wellbeing Compass	-0.272
End of Term 3 # Mixed criteria	-1.220
Project HE:RO # End of Term 1 # Wellbeing Compass	1.868
Project HE:RO # End of Term 1 # Mixed criteria	4.807*
Project HE:RO # End of Term 2 # Wellbeing Compass	9.717
Project HE:RO # End of Term 2 # Mixed criteria	5.551**
Project HE:RO # End of Term 3 # Wellbeing Compass	**11.16*** **
Project HE:RO # End of Term 3 # Mixed criteria	**6.418*** **
Constant	67.73***
N	3047
Model	FE
R-sq (within)	0.0775
R-sq (between)	0.0000698
R-sq (overall)	0.00955
* p<0.10, ** p<0.05, *** p<0.01	

We also explored the how the number of days that a Health Mentor spends in the school affects the performance of the programme. The results suggest that the presence of Health Mentors is as effective on programme participants independently of the number of other days they are in school. However, we notice an **additional increase in wellbeing (+2.316) on schoolmates not in the programme if the Health Mentor was 5 days a week in school** compared to 1 or 3 days. **This is further evidence of potential spill-over effects of the programme.**

Table 4-3 Wellbeing impact by number of days with a HM in school

	Project HE:RO	Schoolmates of Project HE:RO
Project HE:RO	0	
End of Term 1	0.601	-0.775
End of Term 2	-1.008*	-0.684
End of Term 3	0.333	-1.253*
Project HE:RO # End of Term 1	3.531*	
Project HE:RO # End of Term 2	6.968***	
Project HE:RO # End of Term 3	7.137***	

End of Term 1 # Control	-1.377	
End of Term 1 # 5 days a week	0.523	1.900*
End of Term 2 # Control	0.324	
End of Term 2 # 5 days a week	2.415**	2.092
End of Term 3 # Control	-1.586	
End of Term 3 # 5 days a week	0.730	**2.316****
Project HE:RO # End of Term 1 # 5 days a week	-3.040	
Project HE:RO # End of Term 2 # 5 days a week	-0.521	
Project HE:RO # End of Term 3 # 5 days a week	**1.529**	
End of Term 1 # 1 or 3 days a week		1.377
End of Term 2 # 1 or 3 days a week		-0.324
End of Term 3 # 1 or 3 days a week		1.586
Constant	67.70***	68.89***
N	3047	2619
Model	FE	FE
R-sq (within)	0.0649	0.00966
R-sq (between)	0.000616	0.000410
R-sq (overall)	0.0108	0.00424
* p<0.10, ** p<0.05, *** p<0.01		

Notes: The second model excludes Project HE:RO participants so that we can compare their schoolmates to pupils in control schools.

4.2.2 Stronger Brains

Due to the lack of an appropriate control group, it was not possible to test statistically whether any increase in brain health is attributable to the programme. Instead in this section we explore the potential link between wellbeing and brain health as supportive evidence for the programme. We use cognitive data from Schoolmates not in any of the programmes. By excluding pupils enrolled in one of the two programmes from our analysis, we remove the potential bias (i.e. effect) that they have on wellbeing and brain health and are solely interested in understanding how the two outcomes interact in absence of an intervention. Note however, that this has its limits as we have identified the potential wider effects that Project HE:RO has on the school. We do not think however that this should prevent us from drawing conclusions and suggesting next steps for further research.

Reverse causality (whereby brain health impacts on wellbeing, and wellbeing impacts on brain health in a positive feedback loop) may exist. To test this, we first look at the potential effect wellbeing has on brain health (Table 4-4 Wellbeing effect on brain health) and discuss the reversed model later on (Table 4-5 Brain health effect on wellbeing).

Wellbeing – as measured by the Wellbeing Compass score (on a scale of 20-100) – is associated with an increase in brain health – as measured by the average Stronger Brains score (on a scale of 0-100). A one-point increase in wellbeing is associated with a +0.285 increase in brain health. Interestingly, this relationship is not equal in all attributes of wellbeing. **Physical Activity proved to be strongly positively correlated with brain health as is Cognitive Functioning**, respectively associated with an increase of +0.583 and +0.632.

Other attributes of wellbeing such as Diet and Nutrition, Personal Development and Emotional Wellbeing are not found to be associated with brain health. The results for Emotional Wellbeing, which is formed from questions regarding the pupil's enjoyment of school and emotional control (such as "I calm myself down when angry") are not significant, which is **surprising given that emotional regulation is necessary for healthy cognitive functioning**. However, the relationship between later academic achievement and emotional wellbeing is undecided and might be better explained by external factors not considered by this project (e.g. things going on at home that negatively impact a pupil's emotional wellbeing).[33]

The rest of the results are unsurprising with school year level and school term associated with higher Stronger Brains scores, which is to be expected given the link between school year and pupils' academic development.

Table 4-4 Wellbeing effect on brain health

	Stronger Brains	
Physical Activity		**0.583****
Diet and Nutrition		0.236
Personal Development		0.502
Emotional Wellbeing		-0.338
Cognitive Functioning		**0.632****
Wellbeing Compass	**0.285*****	
End of Term 3	5.830***	5.640***
Female	-2.179	-1.619
Year 5	4.724***	4.874***
Year 6	8.925***	8.657***
Constant	14.61***	12.04***
N	454	454
Model	OLS	OLS
R-sq	0.119	0.140

[33] Morrison Gutman & Vorhaus (2012). The Impact of Pupil Behaviour and Wellbeing on Educational Outcomes. Department for Education.

* p<0.10, ** p<0.05, *** p<0.01

Looking at the potential effect of brain health on wellbeing (Table 4-5 Brain health effect on wellbeing), we confirm the absence of a statistical association between Stronger Brains and Emotional Wellbeing. All other domains of wellbeing were found to have a small but positive association with brain health confirming the potential link between the two outcomes of interest. **This proven association suggests that in the case that the programme had a positive impact on wellbeing (as shown in Section 4.2.1), then it is highly likely that it would also improve brain health, given that wellbeing and brain health have been shown to be heavily correlated here in Section 4.2.2.**

As shown in Table 4-4 Wellbeing effect on brain health, a 1-point increase in wellbeing is associated with a +0.285 increase in Stronger Brains. Table 4-5 Brain health effect on wellbeing shows that a 1-point increase in Stronger Brains is associated with a +0.173 in wellbeing. **This suggests the potential for a snowballing effect where an increase in wellbeing leads to an increase in brain health which leads to higher wellbeing, in a positive feedback cycle.** Note that measures of brain health and wellbeing were made, those snowballing effect might have already occurred and therefore we could be overestimating the initial effect.

We note the effect is lower in one direction (Brain health on wellbeing) than the other (Wellbeing on brain health). This is an interesting finding as this would mean that focusing on wellbeing is a good strategy to have an effect on both wellbeing and brain health.

We recommend that further research be undertaken to better understand the feedback link between brain health and wellbeing.

Table 4-5 Brain health effect on wellbeing

	Wellbeing Compass	Physical Activity	Diet and Nutrition	Personal Development	Emotional Wellbeing	Cognitive Functioning
Stronger Brains	**0.173*** **	**0.0436*** **	**0.0258*** **	**0.0417*** **	***0.0192***	**0.0423*** **
End of Term 3	-1.321	-0.118	-0.140	-0.300	-0.426	-0.336
Female	2.588**	0.370	0.629**	0.265	1.153***	0.171
Year 5	-1.645	-0.357	-0.335	-0.561	-0.0953	-0.296
Year 6	-5.812***	-0.794**	-1.064***	-1.728***	-1.461***	-0.765**
Constant	63.80***	11.02***	14.30***	13.63***	12.74***	12.10***
N	454	454	454	454	454	454
Model	OLS	OLS	OLS	OLS	OLS	OLS
R-sq	0.0858	0.0464	0.0529	0.0672	0.0496	0.0470
* p<0.10, ** p<0.05, *** p<0.01						

5 Concluding remarks and next steps

Key findings

Project HE:RO was found to significantly increase pupils' wellbeing as measured by the Wellbeing Compass. At baseline, pupils who were selected into Project HE:RO had on average a wellbeing scores 8.4 points (on a scale of 20-100) lower than the control group. By the end of the third school term, the wellbeing gap was closed, and we see that participants are as happy as their peers with an average increase in wellbeing of +9.7 (on a scale of 20-100). In summary, the wellbeing gap identified between the participants of the programme and their counterpart in control schools was entirely closed off by the end of term 3.

Other findings around the impact of Project HE:RO were that **schools which use Wellbeing Compass as a criterion for enrolling in the programme see an increase in wellbeing scores 2 to 3 times higher** than those who do not; We also found that not only does Project HE:RO increase wellbeing of enrolled participants, but our results suggest that their **schoolmates who are not in the programme also benefitted** from spill-over effects, with increased wellbeing compared to pupils in control schools. Furthermore, those spill-over effects increase with the number of days the health mentors spend in the school.

If proven effective, Project HE:RO and associated programmes would have substantial societal impact over the long term as the economic cost of exclusion is estimated at **£370,000 per young person** in lifetime education, benefits, healthcare and criminal justice costs.[34]

The strong statistical associations between Stronger Brains performance and Wellbeing Compass (in both directions) strongly suggests that **comprehensive brain health improvement is associated with the programme**. That is, improving a pupil's wellbeing can lead to improved cognitive functioning and vice versa. However, the lack of statistical association between Stronger Brains and the Emotional Wellbeing domain seems to suggest the presence of other confounding factors that were not picked up in this evaluation. Further research is needed to investigate what this Wellbeing Compass domain is measuring. However, there are limitations to be considered in this research, such as the small sample sizes, short-term measurement, and Stronger Brains scoring issues. The impacts of these intervention programmes are only recorded over the school year (2018/2019). We do not know what lasting impacts the Health Mentors and programmes had on the pupils' development in the longer term (e.g. over the course of their primary school years). Small sample sizes restricted our confidence that we could conclude the findings for, for example, the Engine Room sample. Scoring issues with some Stronger Brains tasks meant that

[34] Gill, K. et al. (2017) Making the Difference: Breaking the link between school exclusion and social exclusion, Institute for Public Policy Research

performance on these tasks could not be attributed to children's cognitive development without understanding how these scores were compiled, as described below.

For the 11 participants of the Engine Room programme, we observed a significant improvement in their aggregated Stronger Brains scores. The different focus of the Engine Room programme, compared to Project HE:RO, which was to encourage cognitive development, is shown by the improvement in Stronger Brains performance over time. **This suggests the Engine Room programme was successful.**

Limitations and recommendations for future research

The programme was measured over a short period of time (one academic year), while benefits are expected to be long-lasting. Ideally, we would perform such an evaluation over multiple years. We caveat our findings with the assumption that we are only able to measure short-term changes (the length of one term) as no long-term effects can be measured. A longitudinal study would best measure the longer-term effects of Project HE:RO. Similarly, the Engine Room programme contained only 11 pupils at one school, such small sample limits the strength of any statistical inference.

For this analysis, we were lacking a certain amount of ideal control variables. For an impact evaluation of this kind, we would ideally control for more sociodemographic factors than just gender. We would also expect some school class effect. The inclusion of pupils' academic achievements (i.e. school reports and assignment grades) in the analyses might further add to the understanding of the pupil's cognitive development over the course of the interventions. To better understand the long-term effect of the intervention, it would be necessary to collect data on educational outcomes such as attainment, attendance, etc.

We identified that some Stronger Brains activities may have proven too difficult for children (8-11 years) to participate in. Notably, Line Islands, Mandala, and Sound Sweeps, refer to Figure 3-1. Stronger Brains scores are produced by comparing performance to an adult population of past brain training programme (such as BrainHQ) users. This creates an issue where scores of children are significantly lower than the scores obtained by adults. It is therefore not clear whether the task was too difficult for children or if the children's scores were trumped by the adult sample. We recommend future research where scores are produced using children's data.

6 Annex

6.1 Schools involved in the study

Table 6-1 shows some key characteristics of the schools. Six of the schools are maintained schools that are funded and controlled by their local education authority, whilst four of the schools are academies funded directly by the government. All the schools involved with the programme are maintained schools, except for Rosslyn Park which is an academy.

Table 6-1 Key school characteristics

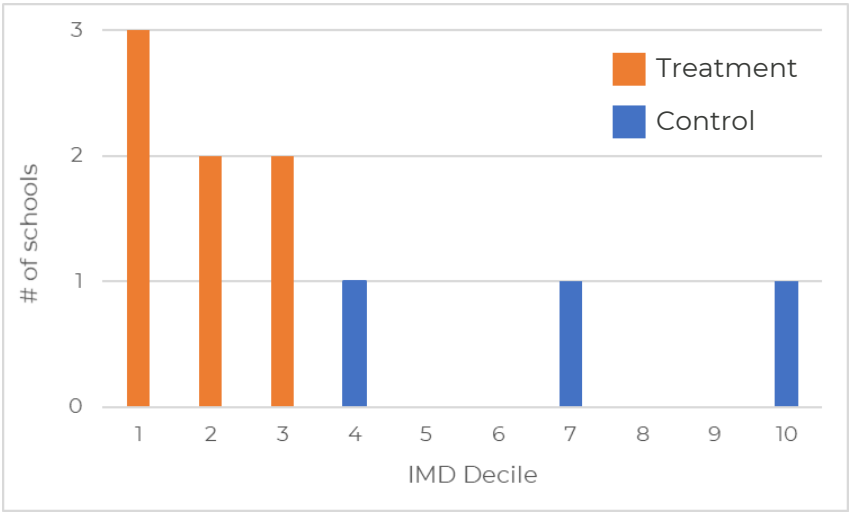
School	Total # of pupils enrolled	Town	Type	Type – further detail	Religious denomination
Blakesley Hall	613	Birmingham	Maintained	Community school	None
St Wilfrid's	423	Birmingham	Maintained	Voluntary aided school	Roman Catholic
Frizinghall	431	Bradford	Maintained	Community school	None
Old Bank	173	Mirfield	Maintained	Community school	None
Seven Sisters	407	London	Maintained	Community school	None
St. Augustine's	451	Worksop	Maintained	Community school	None
Rosslyn Park	691	Nottingham	Academy	Academy sponsor led mainstream	None
Queen Emma's (control school)	226	Witney	Academy	Academy - Converter mainstream	None
Parkgate (control school)	310	Newark	Academy	Academy sponsor led mainstream	None
St. Peter's (control school)	190	Newark	Academy	Academy - Converter mainstream	Church of England

Figure 6-1 shows the geographical distribution of the schools. St. Wilfrid's and Blakesley Hall are both in Birmingham, West Midlands, just 3.3km away from each other. Seven Sisters is in London and Queen Emma's in Oxford. Old Bank and Frizinghall are both located in West Yorkshire in the North of England whilst the rest of the schools are all located in Nottinghamshire in the East Midlands.

Figure 6-1 Location of schools

Figure 6-2 shows the distribution of the ten schools by the Index of Multiple Deprivation (IMD) decile of the Lower-layer Super Output Area (LSOA) that they are located in. The treatment schools are all in the three most deprived deciles which indicates that the treatment is being targeted at the areas that need it the most.

Figure 6-2 Distribution of schools by IMD Decile



6.1.1.1 Comparing treatment schools to other UK primary schools

Figure 6-3 shows a histogram of the percentage of pupils eligible for free school meals (FSM) across all primary schools in England. The numbers above the bars indicate the number of the treatment schools that fall into each interval. Overall, whilst there is a tendency for the treatment schools to have a high percentage of pupils eligible for FSM compared to other primary schools in England.

Figure 6-3 Distribution of UK primary schools in terms of eligibility for FSM

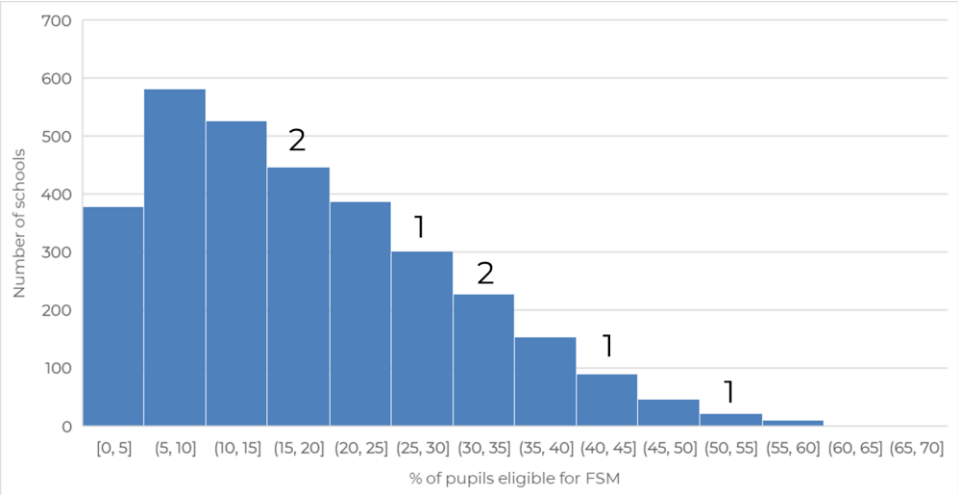
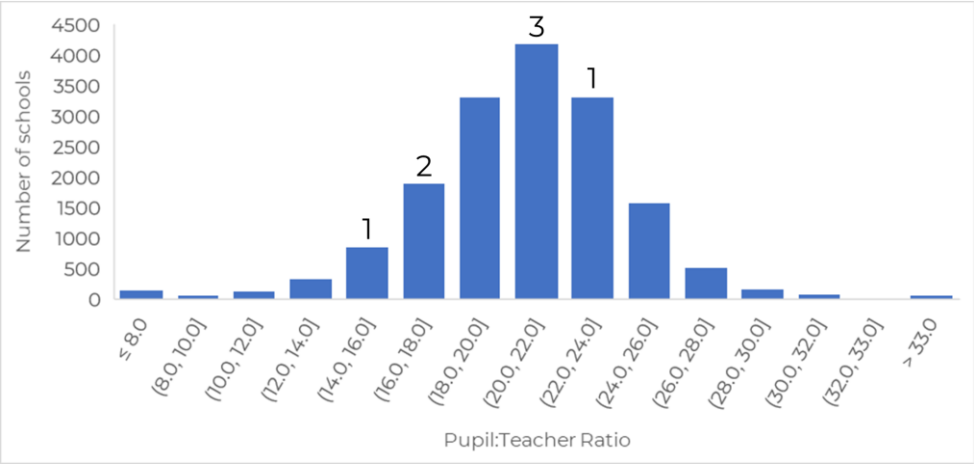


Figure 6-4 shows a histogram of the pupil:teacher ratios across all primary schools in England. Once again, the numbers above the bars indicate the number of the treatment schools that fall into each interval. There is a slight tendency for the treatment schools to have lower pupil: teacher ratios compared to other primary schools in England.

Figure 6-4 Distribution of UK primary schools in terms of Pupil:Teacher Ratio

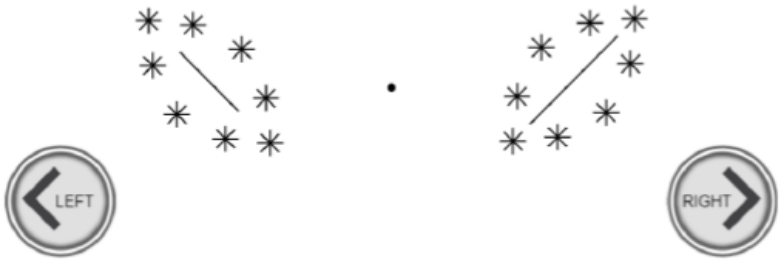


6.2 Cognitive exercises

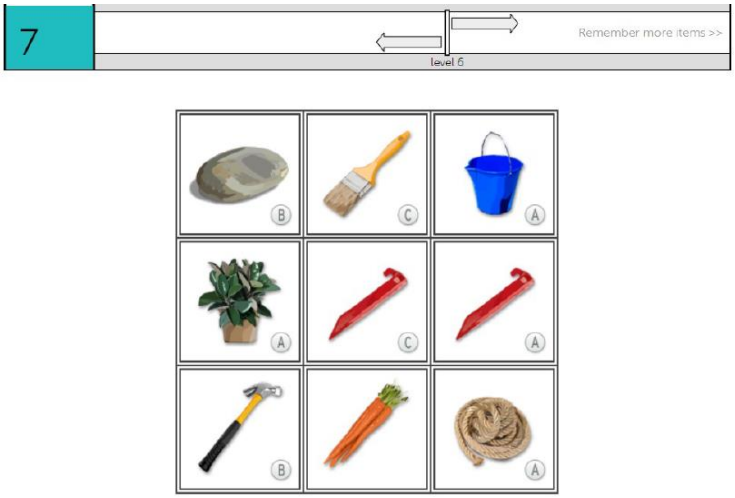
Below are descriptions of the Stronger Brains tasks in detail:

- Bubble Pop (approximately 4 minutes): Respondents track two bubbles that appear on the screen (with sound) and ignore any other bubbles that appear on screen. Respondents select the bubbles that were tracked with the mouse cursor. To reduce compensation strategies, participants are not encouraged to not track the bubbles with their fingers and use only their eyes. The task progresses by increasing the number of bubbles to be tracked.

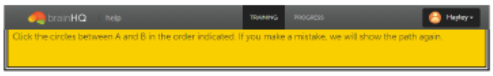
- Line Islands (approximately 3 minutes): Two lines appear on screen, each surrounded by asterisks, with one line longer than the other line. A spot is presented in the middle of the screen to help participants focus and use their peripheral vision. Respondents are asked to decide which line is longer and respond by using the left or right computer keys.

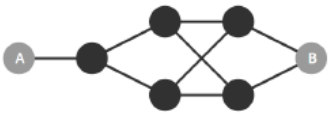


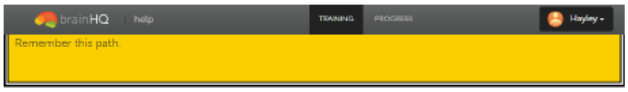
- To Do List (approximately 2 minutes): Participants are given a set of instructions detailing the order of which items to click for the 'To Do List' (e.g. get these items before this item). Discussion of language meaning (e.g. 'stake' or 'plough') may be required with the mentor.

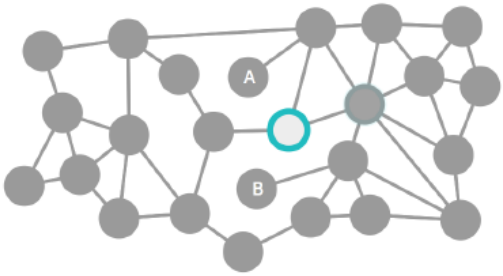


- Path Finder (approximately 2 minutes): Two dots are connected by a series of lines and dots. One dot is labelled ‘A’ and another dot is labelled ‘B’. Participants are asked to watch and remember the path that is shown from dot A to dot B. Participants are encouraged to wear headphones to reduce distraction as the task requires a lot of focus.

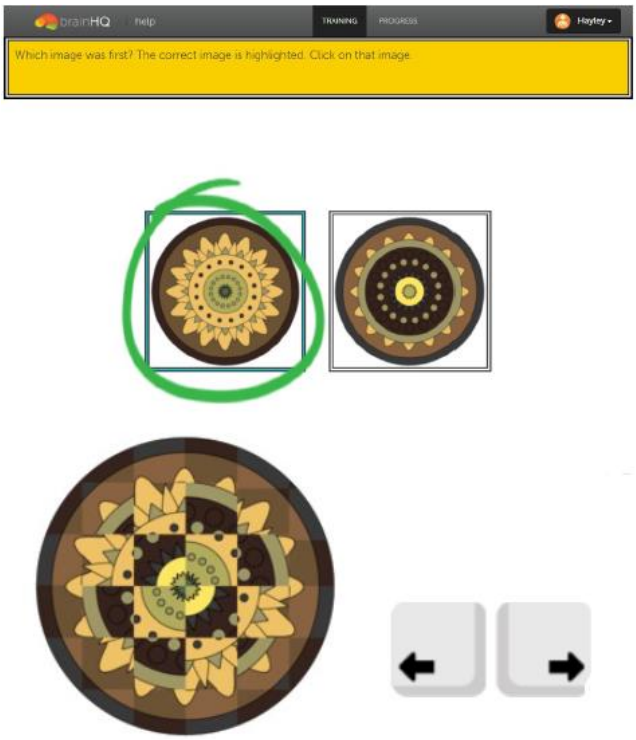




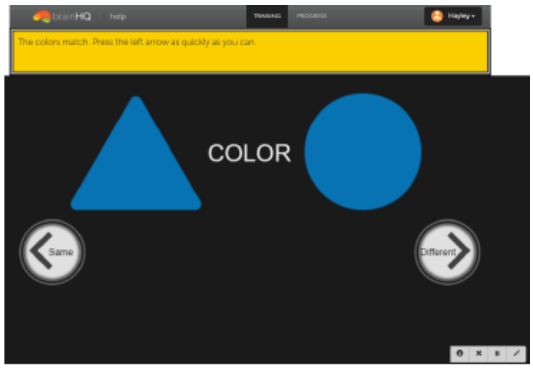


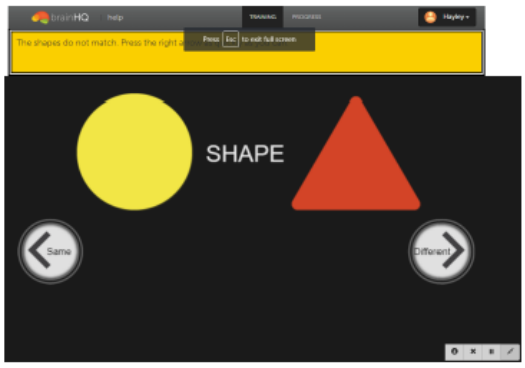


- Mandala (approximately 2 minutes): Two mandala patterns are shown in order before being jumbled up to form one mandala together. Participants choose which of the two mandalas they could see first and which mandala they saw second by using the left or right computer keys.

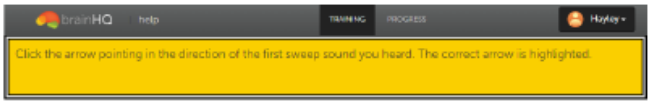


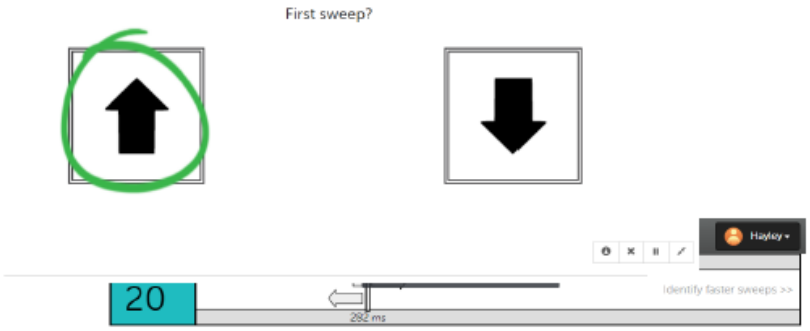
- Rule Switcher (approximately 4 minutes): Two shapes appear on the screen with a rule presented between the shapes (e.g. 'COLOR' or 'SHAPE'). Discussions may be required with participants as American spelling is used (e.g. 'COLOR' rather than 'COLOUR'). Participants are required to determine whether these two shapes fit this rule (e.g. both shapes are presented in the same colour). Participants respond by the left (i.e. 'Same') and right (i.e. 'Different') computer keys. Speed and accuracy are encouraged.

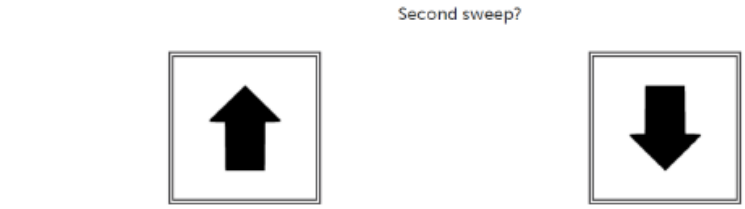




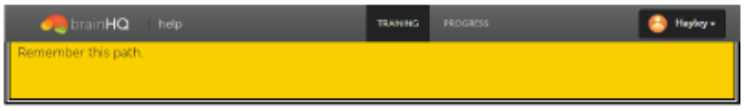
- Sound Sweeps (approximately 3 minutes): Participants are presented with two sounds one after the other that increase (go up) or decrease (go down) in pitch. Participants respond by using the left or right computer key to select the order in which they heard the sounds (i.e. higher pitch followed by the lower pitch or vice versa).

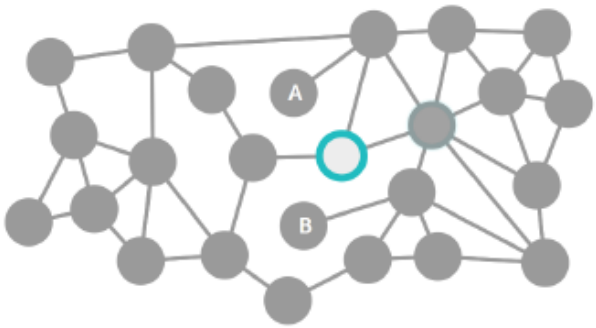






- Memory Lane (approximately 2 minutes): Participants are asked to remember the path from dot A to dot B from an earlier Path finder task in the session. Participants are not aware that they are expected to remember this path for a later task during the initial Path finder task.





The cognitive area that each of the Stronger Brains tasks measure is outlined in Table 6-2 below.

Table 6-2 Cognitive Area by Stronger Brains Task

	Cognitive Area								
Task	Executive Functioning	Attention		Processing Speed		Reaction Time	Working Memory		Visual-spatial Short-term Memory
		Visual	Visual-spatial	Visual	Auditory		Visual	Auditory	
Bubble Pop		X					X		
Line Island		X		X		X			
To Do List								X	
Path Finder			X				X		
Mandala				X		X			
Rule Switcher	X								
Sound Sweeps					X				
Memory Lane									X

6.3 Wellbeing Compass survey questions

Physical Activity questions

In a normal week at school (Monday to Friday), how often during lunch or playtime do you do physical activity that makes you out of breath? (For example, play sports, run around during play, dance):

1. Never
2. Once a week
3. Two or three times a week
4. Four or five times a week
5. Twice a day or more

In a normal week at school (Monday to Friday), how often during PE do you do physical activity that makes you out of breath or challenges you?

1. I stand or sit for most of the lesson not learning any new skills
2. I do some exercise that gets me out of breath
3. I do some exercise and learn some new skills
4. I do exercise that gets me very out of breath
5. I learn lots of new skills and get very out of breath

In a normal week, how often in a before or after school club do you do physical activity that makes you out of breath or challenges you?

1. I never go to a school club
2. I go to a school club once a week
3. I go to a school club once a week where I learn some new skills
4. I go to more than one school club a week where I learn new skills
5. I go to more than one school club where I learn new skills and am active

In a normal week, how often outside of school in the evenings or at weekends do you do physical activity that makes you out of breath or challenges you?

1. Never
2. Once a week
3. Two or three times a week
4. Four or five times a week
5. More often

Diet and nutrition questions

How much do you agree with this statement: 'What I eat is really important for my health'

1. Strongly disagree
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly Agree

On a normal day how many fruits or vegetables do you eat?

1. None
2. 1-2
3. 3-4
4. 5-6
5. 6 or more

On a normal day how many chocolate bars, sweet packets or fizzy drinks do you have?

1. 10 or more
2. 7-9
3. 4-6
4. 1-3
5. None

On a normal day how often do you drink water?

1. Never
2. I have one drink a day
3. I drink water at break times
4. I drink water at break times and at some other times

5. I always drink water through the whole day

Personal development questions

I try very hard even if something is difficult

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

I get along with other people

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

I feel confident

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

I tell the truth

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

Emotional wellbeing questions

I enjoy school

1. I don't ever enjoy school
2. I sometimes enjoy school
3. I enjoy school a lot of the time
4. I enjoy school most of the time
5. I always enjoy school

I have someone to talk to when I'm worried or upset

1. None of the time
2. Some of the time

3. A lot of the time
4. Most of the time
5. All of the time

I can calm myself down when I feel angry

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

I tell someone straight away when another child picks on me

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

Cognitive functioning questions

How often do you enjoy doing something that is difficult and challenges you?

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

How often do your friends ask you for help in class if they are struggling with something?

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

In class how often are you getting on with your work?

1. None of the time
2. Some of the time
3. A lot of the time
4. Most of the time
5. All of the time

How often do your friends finish their work before you?

1. None of the time
2. Some of the time
3. A lot of the time

4. Most of the time
5. All of the time

6.4 Additional regression results

6.4.1 Wellbeing model

As explained in the methodology section, we also explored an Ordinary Least Squares (OLS) and Random Effect (RE) model and obtained results which are sensibly similar to our Fixed Effect model adding to the robustness of our model.

Table 6-3 Wellbeing model: Comparison of OLS, FE and RE

	Wellbeing Compass		
Project HE:RO	-7.249***	0	-7.245***
End of Term 1	2.208	-0.775	0.348
End of Term 2	0.340	-0.684	-0.219
End of Term 3	0.435	-1.253*	-0.546
Project HE:RO # End of Term 1	-0.895	3.284**	1.905
Project HE:RO # End of Term 2	6.412***	7.438***	6.988***
Project HE:RO # End of Term 3	**7.142*** **	**9.725*** **	**8.812*** **
Schoolmates	-0.754	0	-0.657
Schoolmates # End of Term 1	-1.260	1.638*	0.571
Schoolmates # End of Term 2	0.858	0.644	0.547
Schoolmates # End of Term 3	0.467	1.961**	1.339
Female	2.939***		2.980***
Year 5	0.701		0.646
Year 6	0.144		0.432
Constant	67.22***	67.73***	67.00***
N	3047	3047	3047
Model	OLS	FE	RE
R-sq	0.0470	0.0583	
R-sq (within)		0.0583	0.0572
R-sq (between)		0.000532	0.0449
R-sq (overall)		0.00857	0.0314
* p<0.10, ** p<0.05, *** p<0.01			

6.4.2 Cognitive model

Table 6-4 Regression of Stronger Brains on wellbeing

	Stronger Brains											
Wellbeing Compass	0.285***	0.244***										
Physical Activity			0.915***	0.791***								
Diet and Nutrition					0.813***	0.757**						
Personal Development							0.850***	0.699***				
Emotional Wellbeing									0.270	0.168		
Cognitive Functionning											1.015***	0.798***
End of Term 3	5.830***	6.009***	5.615***	5.839***	5.729***	5.979***	5.788***	6.015***	5.821***	6.088***	5.831***	6.034***
Female	-2.179	-1.661	-1.793	-1.219	-1.994	-1.506	-1.687	-1.188	-1.818	-1.178	-1.623	-1.203
Year 5	4.724***	5.063***	4.624***	4.912***	4.653***	5.006***	4.794***	5.153***	4.478***	4.873***	4.584***	4.944***
Year 6	8.925***	8.954***	8.065***	8.201***	8.347***	8.547***	8.840***	8.891***	7.998***	8.160***	8.091***	8.247***
Constant	14.61***	16.84***	23.05***	23.89***	22.17***	22.25***	21.72***	23.20***	30.89***	31.41***	20.75***	22.98***
N	454	454	454	454	454	454	454	454	454	454	454	454
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE
R-sq	0.119		0.110		0.0926		0.106		0.0779		0.113	
R-sq (within)		0.137		0.145		0.157		0.143		0.147		0.127
R-sq (between)		0.118		0.109		0.0921		0.105		0.0768		0.111
R-sq (overall)		0.105		0.0936		0.0711		0.0825		0.0532		0.105
* p<0.10, ** p<0.05, *** p<0.01												

Table 6-5 Regression of Line Islands on wellbeing

	LineIslands											
Wellbeing Compass	0.433***	0.381***										
Physical Activity			1.479***	1.432***								

Diet and Nutrition					1.627***	1.321***						
Personal Development							0.720*	0.560				
Emotional Wellbeing									0.615*	0.428		
Cognitive Functionning											1.490***	1.332***
End of Term 3	7.969***	8.158***	7.686***	7.880***	7.802***	8.069***	7.846***	8.164***	8.013***	8.292***	7.927***	8.162***
Female	3.959	4.580	4.727*	5.369*	4.031	4.740*	4.873*	5.512*	4.269	5.114*	4.835*	5.313*
Year 5	1.909	2.225	1.746	2.013	1.857	2.148	1.918	2.243	1.606	1.993	1.782	2.136
Year 6	14.42***	14.62***	13.16***	13.52***	13.75***	13.98***	13.54***	13.84***	13.28***	13.58***	13.08***	13.50***
Constant	-16.43**	-13.67	-4.930	-5.183	-10.89	-7.175	2.871	4.221	5.482	6.950	-6.423	-5.156
N	437	437	437	437	437	437	437	437	437	437	437	437
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE
R-sq	0.0925		0.0898		0.0842		0.0670		0.0673		0.0864	
R-sq (within)		0.0608		0.0856		0.0548		0.0711		0.0674		0.0684
R-sq (between)		0.0919		0.0896		0.0832		0.0665		0.0664		0.0860
R-sq (overall)		0.107		0.0994		0.101		0.0707		0.0723		0.100
* p<0.10, ** p<0.05, *** p<0.01												

Table 6-6 Regression of Bubble Pop on wellbeing

	BubblePop											
Wellbeing Compass	0.283***	0.235**										
Physical Activity			0.558	0.494								
Diet and Nutrition					1.195***	1.154***						
Personal Development							0.886***	0.768**				
Emotional Wellbeing									0.238	0.0404		

Cognitive Functionning											1.145***	0.859**
End of Term 3	5.478**	6.639***	5.340**	6.584***	5.362**	6.551***	5.441**	6.641***	5.491**	6.737***	5.486**	6.664***
Female	-1.802	-1.377	-1.190	-0.770	-1.810	-1.522	-1.320	-0.960	-1.282	-0.670	-1.260	-0.942
Year 5	6.760***	7.313**	6.671***	7.192**	6.793***	7.338**	6.873***	7.460***	6.568**	7.167**	6.652***	7.231**
Year 6	7.514***	8.527***	6.467**	7.700**	7.250***	8.462***	7.512***	8.612***	6.404**	7.515**	6.780**	7.903**
Constant	1.512	2.920	14.15***	12.91**	3.104	1.784	7.906	7.638	17.96***	18.47***	5.771	7.649
N	437	437	437	437	437	437	437	437	437	437	437	437
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE
R-sq	0.0507		0.0367		0.0494		0.0463		0.0323		0.0530	
R-sq (within)		0.108		0.117		0.121		0.111		0.116		0.0992
R-sq (between)		0.0492		0.0361		0.0488		0.0453		0.0307		0.0505
R-sq (overall)		0.0362		0.0204		0.0386		0.0326		0.0153		0.0408
* p<0.10, ** p<0.05, *** p<0.01												

Table 6-7 Regression of To Do List on wellbeing

	ToDoList											
Wellbeing Compass	0.479***	0.473***										
Physical Activity			1.547**	1.595**								
Diet and Nutrition					0.931	0.922						
Personal Development							1.725***	1.659**				
Emotional Wellbeing									0.623	0.601		
Cognitive Functionning											1.406**	1.315*

End of Term 3	1.778	1.639	1.528	1.371	1.591	1.501	1.661	1.556	1.844	1.760	1.767	1.648
Female	-0.646	-0.636	0.301	0.360	-0.0131	0.0128	0.108	0.147	-0.309	-0.242	0.277	0.273
Year 5	10.72**	11.13**	10.42**	10.79**	10.50**	10.91**	11.04**	11.48**	10.36**	10.79**	10.41**	10.84**
Year 6	10.86**	10.84**	9.471*	9.456*	9.428*	9.451*	11.23**	11.18**	9.445*	9.468*	9.174*	9.172*
Constant	23.32*	23.71*	37.06***	36.50***	42.60***	42.70***	30.72***	31.64***	48.43***	48.66***	37.72***	38.94***
N	436	436	436	436	436	436	436	436	436	436	436	436
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE
R-sq	0.0310		0.0279		0.0166		0.0315		0.0165		0.0238	
R-sq (within)		0.00289		0.00961		0.000256		0.00279		0.000774		0.0000683
R-sq (between)		0.0309		0.0278		0.0166		0.0315		0.0165		0.0237
R-sq (overall)		0.0509		0.0474		0.0328		0.0438		0.0293		0.0420
* p<0.10, ** p<0.05, *** p<0.01												

Table 6-8 Regression of Path Finder on Wellbeing

	PathFinder											
Wellbeing Compass	0.267**	0.238**										
Physical Activity			1.191***	1.037**								
Diet and Nutrition					0.793	0.639						
Personal Development							0.664*	0.617				
Emotional Wellbeing									0.138	0.0824		
Cognitive Functionning											0.862**	0.788**
End of Term 3	6.966***	6.844***	6.724***	6.634***	6.893***	6.825***	6.953***	6.870***	6.912***	6.864***	6.936***	6.845***
Female	-8.795***	-8.519***	-8.340***	-8.029***	-8.536***	-8.234***	-8.290***	-8.043***	-8.262***	-7.923***	-8.305***	-8.105***

Year 5	6.581**	6.915**	6.686**	6.912**	6.558**	6.861**	6.625**	6.983**	6.445**	6.791**	6.518**	6.866**
Year 6	14.71***	14.49***	14.08***	13.89***	14.26***	14.06***	14.48***	14.35***	13.75***	13.64***	13.94***	13.84***
Constant	16.93**	18.70**	20.49***	22.16***	23.38***	25.41***	25.47***	25.84***	33.63***	33.99***	23.92***	24.61***
N	421	421	421	421	421	421	421	421	421	421	421	421
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE
R-sq	0.101		0.109		0.0937		0.0939		0.0876		0.0968	
R-sq (within)		0.0566		0.0498		0.0520		0.0577		0.0536		0.0599
R-sq (between)		0.101		0.109		0.0935		0.0938		0.0875		0.0967
R-sq (overall)		0.0944		0.108		0.0907		0.0890		0.0850		0.0905
* p<0.10, ** p<0.05, *** p<0.01												

Table 6-9 Regression of Mondala on wellbeing

	Mandala											
Wellbeing Compass	0.324***	0.262**										
Physical Activity			1.118**	0.991**								
Diet and Nutrition					0.368	0.291						
Personal Development							1.048**	0.785*				
Emotional Wellbeing									0.405	0.223		
Cognitive Functionning											1.240***	1.032**
End of Term 3	11.93***	11.48***	11.73***	11.32***	11.84***	11.51***	11.92***	11.51***	11.95***	11.58***	11.91***	11.49***
Female	-8.427***	-7.227**	-7.944***	-6.716*	-7.993***	-6.761*	-7.992***	-6.813**	-8.221***	-6.827**	-7.934***	-6.877**
Year 5	9.624***	10.16***	9.618***	10.04***	9.660***	10.14***	9.755***	10.29***	9.535***	10.09***	9.554***	10.12***
Year 6	15.74***	15.44***	14.83***	14.69***	14.69***	14.63***	15.79***	15.44***	14.84***	14.65***	14.83***	14.75***
Constant	2.758	6.443	11.21*	12.23*	19.68**	20.14**	9.561	12.84*	19.90***	21.59***	8.613	10.83

N	424	424	424	424	424	424	424	424	424	424	424	424
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE
R-sq	0.0982		0.0972		0.0849		0.0960		0.0865		0.0984	
R-sq (within)		0.104		0.109		0.110		0.105		0.108		0.107
R-sq (between)		0.0976		0.0968		0.0845		0.0951		0.0857		0.0979
R-sq (overall)		0.0849		0.0833		0.0671		0.0792		0.0687		0.0856
* p<0.10, ** p<0.05, *** p<0.01												

Table 6-10 Regression of Rule Switcher on wellbeing

	RuleSwitcher											
Wellbeing Compass	-0.0401	-0.0524										
Physical Activity			-0.196	-0.270								
Diet and Nutrition					0.0629	0.115						
Personal Development							-0.00971	-0.0635				
Emotional Wellbeing									-0.0807	-0.0945		
Cognitive Functionning											-0.259	-0.314
End of Term 3	1.422	1.543	1.458	1.611	1.445	1.577	1.441	1.557	1.416	1.529	1.419	1.553
Female	2.909	2.902	2.871	2.846	2.796	2.729	2.828	2.802	2.914	2.895	2.850	2.826
Year 5	0.0466	0.0280	0.0564	0.0440	0.0861	0.0855	0.0728	0.0473	0.0781	0.0697	0.0249	0.000763
Year 6	-2.258	-2.345	-2.159	-2.223	-2.016	-2.005	-2.089	-2.196	-2.183	-2.234	-2.198	-2.260

Constant	52.12***	52.88***	51.77***	52.58***	48.34***	47.44***	49.46***	50.18***	50.40***	50.49***	52.83***	53.47***
N	418	418	418	418	418	418	418	418	418	418	418	418
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE
R-sq	0.00295		0.00308		0.00282		0.00280		0.00287		0.00324	
R-sq (within)		0.00710		0.0153		0.00691		0.00500		0.00427		0.0136
R-sq (between)		0.00294		0.00305		0.00280		0.00277		0.00286		0.00322
R-sq (overall)		0.00266		0.00180		0.00169		0.00243		0.00261		0.00178
* p<0.10, ** p<0.05, *** p<0.01												

Table 6-11 Regression of Sound Sweeps on wellbeing

	SoundSweeps											
Wellbeing Compass	0.295***	0.286***										
Physical Activity			0.590*	0.581								
Diet and Nutrition					0.274	0.413						
Personal Development							0.984***	0.930***				
Emotional Wellbeing									0.737**	0.741**		
Cognitive Functionning											1.024***	0.760*
End of Term 3	0.585	0.943	0.438	0.896	0.478	0.955	0.659	1.044	0.640	1.073	0.542	0.952
Female	-6.512**	-6.026**	-5.889**	-5.307*	-5.907**	-5.444*	-5.983**	-5.483**	-6.681***	-6.152**	-6.071**	-5.516**
Year 5	4.936*	5.146	4.889*	5.037	4.880*	5.079	5.034*	5.274*	4.732	4.945	4.948*	5.143

Year 6	2.490	2.435	1.416	1.403	1.467	1.599	2.548	2.508	2.204	2.214	1.811	1.696
Constant	3.776	3.762	16.87***	16.28***	20.10**	17.28**	9.396	9.539	14.44***	13.73**	10.54*	13.40**
N	381	381	381	381	381	381	381	381	381	381	381	381
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE
R-sq	0.0427		0.0293		0.0237		0.0403		0.0372		0.0390	
R-sq (within)		0.00496		0.0113		0.0122		0.00302		0.00950		0.00278
R-sq (between)		0.0426		0.0291		0.0232		0.0401		0.0370		0.0382
R-sq (overall)		0.0490		0.0258		0.0230		0.0461		0.0408		0.0456
* p<0.10, ** p<0.05, *** p<0.01												

Table 6-12 Regression of Memory Lane on wellbeing

	MemoryLane											
Wellbeing Compass	0.179	0.178										
Physical Activity			1.002**	0.976*								
Diet and Nutrition					0.738	0.710						
Personal Development							0.105	0.0948				
Emotional Wellbeing									0.0691	0.0822		
Cognitive Functionning											0.636	0.644
End of Term 3	9.286***	9.328***	9.086***	9.125***	9.283***	9.327***	9.255***	9.313***	9.253***	9.312***	9.284***	9.333***
Female	0.995	1.169	1.186	1.375	1.049	1.244	1.392	1.598	1.326	1.508	1.261	1.424
Year 5	-3.355	-3.413	-3.302	-3.382	-3.352	-3.422	-3.432	-3.500	-3.484	-3.551	-3.300	-3.351
Year 6	5.279	5.340	4.899	4.942	5.225	5.271	4.683	4.758	4.638	4.736	4.849	4.928
Constant	39.65***	39.57***	39.61***	39.77***	40.83***	41.07***	50.55***	50.48***	51.22***	50.83***	43.57***	43.27***
N	382	382	382	382	382	382	382	382	382	382	382	382
Model	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE	OLS	RE

R-sq	0.0301		0.0359		0.0298		0.0264		0.0264		0.0295	
R-sq (within)		0.0447		0.0448		0.0470		0.0460		0.0466		0.0458
R-sq (between)		0.0301		0.0358		0.0298		0.0264		0.0263		0.0295
R-sq (overall)		0.0295		0.0315		0.0233		0.0226		0.0226		0.0302
* p<0.10, ** p<0.05, *** p<0.01												

6.5 Interview with an Engine Room Health Mentor

An interview was conducted with a Health Mentor, Philippe Lewis, who has administered both Project HE:RO and Engine Room intervention since 2017 at a school in the Haringey borough of London, to establish a personal account on children's improvement from the programme.

The Health Mentor noticed changes from the application of both Project HE:RO and Engine Room programmes. Students who participated in both programmes showed improvement on maths and reading and pupils were more willing to take part in more physical activity. Lower attainers were more willing to challenge themselves, grow their mindsets, and improve on their emotional wellbeing, as encouraged by the Engine Room programme. Social changes were reported with the improvement in manners in playgrounds and breakfast clubs. Pupils in the programmes were encouraged to show respect and make sure no one was left out to participate in the games and activities run within the programme. Pupil engagement was key for success of the Engine Room programme, as around two thirds of pupils were engaged from the beginning, but the remaining third who were not initially engaged, struggled with programme attendance overall.

The biggest change witnessed by the Health Mentor over the two years he has worked with the school was pupil behaviour, with fewer negative behavioural incidents at the school and more engagement in activities in the lunch-time period (as run by the Health Mentor). Part of the behavioural success has been working with teachers and educators to give children strategies for when they get angry during lessons. For example, a Year 4 pupil who caused problems in class was given a "come-down" place (5-10 minutes per lesson).

Wider impacts were reported from a Year 3 teacher, who recalled that other pupils in the class, who had not participated in the programmes, were more focused in general, which meant the teacher could focus more on teaching.

One Year 3 teacher recalled how a pupil who was part of the programme, had improved in classroom behaviour since starting the Engine Room programme:

> ***"(Now) he never gives up and he's always willing to try challenges. He tries his best 3 out of 4 lessons, whereas before it was much less. Before, he was just 'existing'...He [has now] exceeded expectations in the (Reading) assessment."***

Positive relationships with teachers and educators, with an openness to the role of the Health Mentor and the programmes from the beginning, facilitated the programme's success. Weekly catchups with teachers (whose pupils attended the programmes) were conducted to share progress and form education plans for the pupils. During a weekly meet-up, one Year 4 teacher commented:

> ***"Thank you for communicating with me, this is really helpful. It means we can work together to help [child's name] improve their behaviour."***

The Assistant Head of the school made the comment on their school's Health Mentor, Philippe:

> ***"He (Philippe) has shown a lot of 'outside the box' thinking when working with the key worker kids during lockdown. Things like the salamander habitat[35] is just the sort of thing we want to see."***

[35] Philippe worked over the COVID-19 period with key worker's children by engaging them in activities. One activity had pupils designing an artificial salamander habitat for salamanders they had found.