SEEN Oxford

Secondary Education around Early Neurodevelopment

SEEN Oxford

SECONDARY EDUCATION
AROUND
EARLY NEURODEVELOPMENT

University of Oxford

Kindred²

2021

Executive summary

The SEEN (Secondary Education around Early Neurodevelopment) Oxford project aims to embed an understanding of the key principles of early child development through the science curriculum. It has been delivered through three lessons for Key Stage 3 (KS3) classes covering brain development, the role of the caregiver, and implications for long-term health outcomes.

There have been huge challenges for everyone working in education during the pandemic. Despite this, we are delighted to report that the study has been successfully adopted and received overwhelmingly positive feedback from participating teaching staff and young people.

- A total of 3722 pupils took part in the lessons across 29 schools, involving over 100 teaching staff
- Pupils demonstrated both increased knowledge about development and an understanding of how this was applicable to practical situations after the SEEN lessons.
- 100% of teachers and 91% of pupils felt the SEEN curriculum should be taught to other pupils of the same age.

Pupils' knowledge and understanding of the science of children's early experiences was assessed through completion of multiple choice questions before and after taking part in the lessons. The mean score for all pupils increased from 3.09 to 4.78.

Pupils were also asked about the practical application of the SEEN curriculum "*How could you support a toddler's brain development through play?*" Before the lessons, 11% of pupils demonstrated knowledge and understanding beyond what would be expected from general knowledge and everyday experiences. Importantly, after the lessons nearly 50% provided answers that demonstrated good or excellent understanding of the carer's role in promoting early neurodevelopment.

The post-lesson surveys included a number of questions to explore the feasibility and acceptability of the curriculum content for pupils and teachers. Many teachers reported plans to continue teaching the SEEN lessons for subsequent year groups. When asked to specify a preference for delivery through science or PSHE, the majority of teachers chose science. Pupils' enthusiasm and interest in the lesson content was reflected in a third reporting that they had shared something they had learnt with someone outside the classroom, most frequently their parent or carer.

The SEEN curriculum offers an exciting opportunity to introduce the importance of the early years to all pupils during their secondary education. This could serve as a foundation on which to build a community wide knowledge to enhance mental and physical health outcomes for future generations.

SEEN Team, Department of Psychiatry, University of Oxford

Dr Louise Dalton, Dr Elizabeth Rapa, Louise Aukland, Ella Lloyd-Newman and Amy McCall

Rationale

The first 1001 days (pregnancy and the first two years of a child's life) are a critically important period for human development that significantly influence a child's long-term health, well-being, learning and earnings potential. The early years provide the foundation for children's nascent emotional wellbeing, resilience and adaptability.

A baby is primed for social interactions from birth, but for this to happen they need a parent or caregiver, to respond positively to their cues. Sensitive and responsive parent-infant relationships have been shown to be pivotal for the development of infants' social, emotional, behavioural and cognitive skills. These are the building blocks for child and adult outcomes, with longitudinal research repeatedly demonstrating that these skills are associated with better long term mental and physical health. It is therefore essential that this science is shared and understood across communities, so that everyone is equipped with the knowledge and understanding of how their behaviour and parenting contributes to children's futures.

There is also a compelling economic argument for investing in early childhood; the impact of early adversity results in deficits which reduce adults' subsequent productivity and increase social costs. Nobel Laureate James Heckman in 2012 concludes:

"Starting at age three or four is too little too late, as it fails to recognize that skills beget skills in a complementary and dynamic way. The best investment is in quality early childhood development from birth to five for disadvantaged children and their families."

The SEEN project aimed to embed an understanding of why the early years are so important through a series of three science lessons for pupils in Key Stage 3 (age 11-14). Science is a mandatory subject for all pupils of this age, offering an opportunity to equip the next generation with this essential knowledge. It is key not only for parents and caregivers, but for everyone working across multiple sectors (including education, health, social care and the criminal justice system) to inform policy and service delivery. This universally held understanding of the science behind brain development can help to reduce the risk of both physical and mental health problems in society.

Project outline

This pilot project had 2 phases; an initial scoping phase involving 6 schools which informed the content and delivery of the subsequent pilot phase (hereafter described as the project).

Expert advisory groups

Two expert advisory groups were convened to guide the project and provide input on the curriculum content and resources, project evaluation and acceptability. Three meetings were held with the academic group (November 2020-March 2021) and two meetings with the education group (December 2020- March 2021).

The role of the academic expert advisory group was to review the relevant neuroscientific research and consider the priorities for which key concepts should be included.

Prof Peter Fonagy – Head of Psychology and Language Sciences, UCL: Chief Executive of the Anna Freud National Centre for Children and Families, London.
Laura Henry-Allain MBE – Leading, award-winning expert in Early Years education and children's media.
Prof Eamon McCrory – Developmental Neuroscience and Psychopathology, UCL; Co-Director of the UK Trauma Council.
Dr Michelle Fernandes – NIHR Biomedical Research Centre Career Track Fellow in Paediatrics, University of Southampton and Honorary Research Fellow, Nuffield Department of Women's & Reproductive Health, University of Oxford.
Prof Elizabeth Meins – Professor of Developmental Psychology, University of York.
Dr David Whitebread – Developmental Psychologist and Early Childhood Education Expert, University of Cambridge. Sadly, David died in April 2021; we are honoured that he was part of this project and grateful for his expertise and invaluable, thoughtful contributions.
Prof Alan Stein – Consultant Child and Adolescent Psychiatrist, University of Oxford.

The education expert advisory group provided advice on the preferred structure and content of the lessons, and the steps necessary for successful implementation into schools.

Thandiwe Banda – Faculty Leader for Science, The Beacon School
John Blake - Head of Public Affairs and Engagement, Ark
Adam Boxer – Head of Science, The Totteridge Academy
Julian Clarke – Head of Curriculum – Science, AQA
Dame Kate Dethridge - Regional Schools Commissioner, North-West London and South Central England, Department for Education
Maggie Farrar – Lead Associate, Schools Partnership Programme
Ben Littlewood – Director of Science, United Learning
Dr Oliver Wimborne – Head of Curriculum Centre, Future Academies

Curriculum content

The curriculum was created based on the Oxford teams' expertise combined with the advisory groups' recommendations. Scientific research has identified three core parenting capacities which are critical for different aspects of child development:

i) The caregiver's focus of attention to child signals and associated contingent responsiveness (Serve and Return) is essential for the development of the child's cognitive ability. Contingent responses to the infant also teach the infant about connections between stimuli and responses, and help establish and develop the infant's own attentional skills.

ii) Emotional scaffolding or parental support (particularly in times of infant distress) plays a key role in promoting infant emotional regulation, principally through warmth, consistent support and low levels of intrusiveness and coercion during stressful situations. This is key for the development of a child's own emotional regulation skills and behaviour.

iii) 'Sensitivity', generally defined as parental availability and appropriate responsiveness to the infant, has been shown to be an important predictor of attachment. Two key related concepts are i) 'reflective functioning' which refers to parents' ability to hold **both** their **own** thoughts and feelings about a situation, whilst attempting to simultaneously understand **their child's** feelings and behaviour and ii) parental 'mind-mindedness' which refers to a parent treating the infant as having their own thoughts, feelings and **'their own mind'**. Both are important for a child's attachment security.

It was decided to include the following information and themes. (*The italicised content indicates extension materials for more able pupils or where more time was available*).

1. The brain is made up of billions of interconnected neurons.
2. Genetics and environment both have a role to play in brain development; *epigenetics means that even the genes aren't fixed*.
3. New experiences can lead to new neural circuits being formed.
4. Circuits can be strengthened and weakened by individual experiences.
5. The ability of the brain to change throughout a person's life is called neuroplasticity.
6. The brain is particularly plastic, and therefore sensitive to experiences, in the early years (0-5) and adolescence (11-25).
7. Essential neural pathways are developed in the uterus and throughout the early years.
8. Babies are able to perceive and discriminate environmental stimuli in the uterus and throughout the early years.
9. Caregivers can improve long-term health outcomes by supporting brain development in the early years through:
    a. responsive, reciprocal caregiver-child interactions (Serve and Return)
    b. baby talk or 'Motherese'
    c. playful learning
    d. developing executive function skills.
10. The early years are a foundation for long term physical and mental health.
11. What happens in the early years is not deterministic.
12. Resilience is dependent on supportive relationships and developing skills.

The content was then developed into 3 lessons (summarised below). Content for additional lessons homework and revision sessions, were also created to extend and reinforce learning.

Lesson 1 – Brain development in the early years: The neuroscience that underpins child development including the rapid proliferation of neurons following conception. Both genes and the environment affect brain growth in the early years. Connections are made between neurons as babies are exposed to new experiences. Connections are strengthened or weakened depending on a baby's experience. The ability of the brain structure to change based on experiences, also termed neuroplasticity.

Lesson 2 – Caregivers and the early years: The key influence of caregivers on babies' day-to-day experiences. Caregivers' actions directly affect brain development and can ensure healthy brain development during the sensitive early years (conception to 5 years). Key behaviours include responsive caregiver-child interactions; baby talk ('Motherese') and playful learning. Practical application of this knowledge and skills. Extension or optional homework activity about development of executive function skills.

Lesson 3 – Brain development throughout life: Research from longitudinal studies show the importance of the early years for long term health outcomes. The early years are not deterministic, and adolescence is another sensitive period for brain development. Supportive relationships and the development of executive function skills can improve resilience at any life stage. The early years remain the most effective period for improving outcomes.

Materials

The lessons were designed to be delivered by classroom science teachers. Specific knowledge of neuroscience and the early years was not essential; a teacher training pack was developed in response to support teachers deliver the lessons. The pack included a pre-recorded online training session, background to the content and support for lesson planning. Teachers were also offered live online training on request.

It was essential that the lessons could be delivered in a variety of ways due to the COVID-19 pandemic; this included classroom or online delivery by teachers, or independent learning through pre-recorded lessons. The curriculum materials were designed for maximum flexibility; core content was provided in a non-PDF format so teachers could amend as necessary and choose worksheets and activities depending on the delivery format and age or ability of the pupils. This flexibility ensured high quality delivery as teachers tailored materials appropriate for *their* class and context.

The materials were publicly available to view and download from the Department of Psychiatry website:

https://www.psych.ox.ac.uk/research/seen

The curriculum materials included:

- Teacher:
    - Project description and rationale
    - Core content summary
    - Overview of lessons and resources
    - Lesson plans
    - Electronic links to evaluation surveys (plus back up printable version)

- Keyword lists
- Information about safeguarding young people
- Cross-curricular links
- Implementation advice for coordinating teachers
- Extension and differentiation materials
- Additional sources of information including research papers

- Lessons
  - PowerPoints
  - Worksheets (foundation, higher and extension)
  - Pre-recorded lessons and accompanying pupil pack for delivery without a teacher

Data collection

A variety of quantitative and qualitative methods were used to evaluate the SEEN lessons. Pupils' knowledge and its practical application was assessed before the lessons (pre), on completion of the 3 lessons (post) and 6-8 weeks (follow up) after the lessons. Marking schemes were devised for each dataset (see Appendix). Pupils and teachers were also asked about their experience of the SEEN lessons.

Demographics

Pupils were asked to provide basic background information so that the data could be analysed by year group and method of lesson delivery:

- School name
- Year group
- Gender
- Teacher name
- Class/group name
- Lesson delivery (classroom taught by a teacher; online taught by a teacher or self-taught; other)

Scientific knowledge

Pupil's knowledge of the key scientific constructs from the SEEN curriculum were assessed through 10 Multiple Choice Questions:

1. What is the name of nerve cells in the brain?
2. Which of the following is the best definition of neuroplasticity?
3. How do experiences shape the structure of the developing brain?
4. Why is it important for a caregiver to communicate and respond to their child with their voice, eye contact or touch?
5. When do children start playing a role in conversations?
6. How should a caregiver speak to a baby?
7. At what age do you think a child's brain is developing fastest?
8. Which of the following affects how children develop during their first 5 years of life?
9. When is the brain most sensitive to experiences?
10. Which of the following has/ have an impact on an individual's resilience?

Application of knowledge

Pupils were asked to complete a short answer question to assess the link between their understanding of the science and how this could be applied in practical situations:

"Imagine you are asked to help look after a friend's 2-year-old child for the day. Explain what you can do to support the child's brain development as you play together. Give three different examples. You can write 'I don't know' if you need to"

Experience of the SEEN lessons

Pupils

1. How interesting did you find each SEEN lesson rated from 1 (Not at all interesting) to 10 (Very interesting). To benchmark ratings, pupils were also asked how interesting they found a standard science lesson
2. How much did each SEEN lesson and a standard science lesson, make you think differently about babies/young children rated from 1-10
3. Do you think that pupils your age at other schools should be taught the lessons; Yes or No? Why do you think this?
4. Did you share anything you learned in these lessons with anyone outside of your class (e.g. parent or friend; Yes or no? If yes *who* did you tell? And *what* did you share with them?
5. Tell us one thing you 1) Learnt 2) Enjoyed 3) Want to know more about
6. What three words would you use to describe the lessons?

Teachers

1. Using a scale from 1 (Strongly disagree) to 10 (Strongly agree) please rate the following statements:
    a. The teacher pack was comprehensive and clear
    b. I felt I had sufficient knowledge to deliver the lessons
    c. The teaching resources were easy to access
    d. The resources were appropriately pitched for a KS3 lesson
    e. Students were engaged in the activities
    f. The materials were flexible enough for differentiation to be easy
    g. The lessons were about the right length
    h. The lessons could be delivered in a variety of ways (in class or online)
    i. I would recommend the resources to other teachers
2. Using the scale 1-10 please rate each SEEN lesson in terms of 1) **Challenge** where 1 is not at all, 5 is right level of challenging and 10 is far too challenging 2) **Interest** where 1 is not at all interesting and 10 is extremely interesting
3. What you think went well
4. What you think did not go well
5. What were your expectations when signing up to deliver the lessons?
    a. Do you feel that these expectations were met? Why?
6. Do you think brain development during early childhood should be covered in school? Yes in science; Yes in PSHE; No. Why do you think this?

Pupils and Teachers

Pupils and teachers were invited to participate in Focus Group Discussions (see interview guide in Appendix) to enable more detailed exploration of their experiences of the SEEN project.

Teachers were asked for feedback about preparing and teaching the lessons, the response of their class and ideas about any aspects of the training, materials or content that could be improved.

Pupils were asked for their feedback about taking part in the lessons, what they had learnt, additional content they thought should be included and what they would tell other pupils or teachers about the lessons.

Results

Demographics

Participating schools

Six schools participated in the scoping phase of the project (January – March 2021). Four hundred and eighty nine pupil surveys were completed in KS3 Science, with feedback from participating teachers about both the lesson content, materials and experience of delivering the lessons.

Twenty schools of varying types participated in the project across England (figure 1 and table 1). Pupils' responses on the evaluation surveys named 108 teachers who had delivered the lessons, with an additional mention of 24 further members of staff.

A further 3 schools participated in the project; data from these pupils are presented separately in the Results section ('Results from Schools outside of England' and 'SEEN lessons delivered in PSHE') as one school delivered the lessons in PSHE (rather than in Science) and 2 schools were outside of England and therefore follow a different curriculum.

A full list of participating schools can be found in the Appendix.

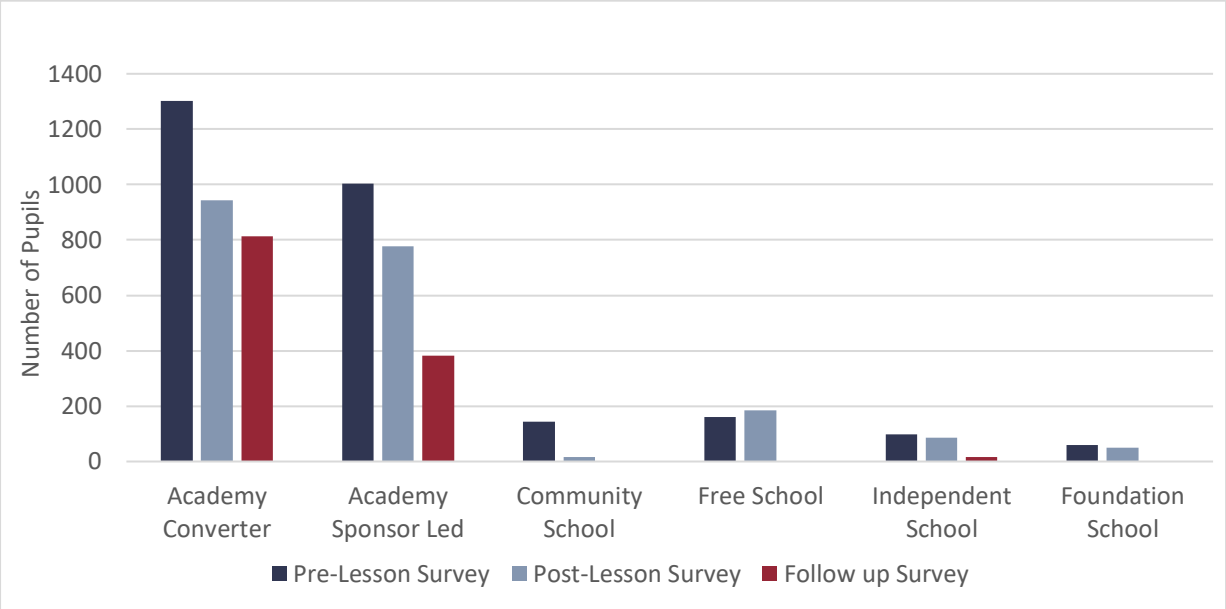
Figure 1: Map showing location of participating schools

Table 1: Type of participating schools

School Type	Number of Schools
Academy Converter	8
Academy Sponsor Led	5
Independent School	4
Community School	1
Foundation School	1
Free School	1

The number of pupil surveys collected from each school type is shown in figure 2; with academy convertor and academy sponsor led schools contributing the majority of the quantitative data.

Figure 2: Number of completed surveys by school type



Teacher training

Teachers were offered a range of training options in preparation for delivering the SEEN lessons; these included attending a live online training session with the SEEN team, watching a pre-recorded online training film and reading an online written teacher pack.

Lesson delivery

Pupils were asked to state how the lessons had been delivered, with the majority being taught in the classroom by a teacher (table 2).

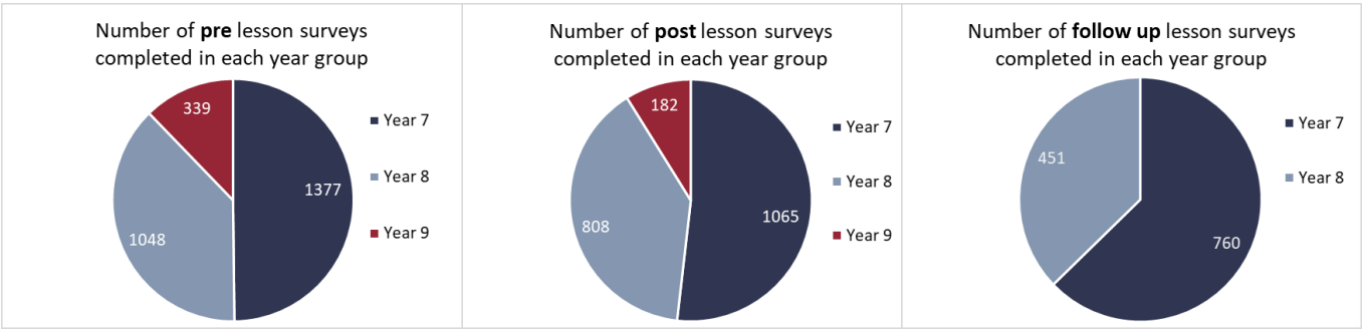
Table 2: Mode of SEEN lesson delivery

Lesson Delivery	N
In the classroom, taught by a teacher	1955
Online lesson, taught by a teacher	49
Online lesson, self-taught	25
Other	27

A total of 3722 pupils took part in the lessons. Of these, 489 pupils participated in the scoping phase. In the project, 3233 pupils completed surveys; of these, 293 pupils took part in the lessons as part of PSHE (rather than science) and 173 were outside of England.

Therefore, the following data are presented for **English schools** in which the SEEN curriculum was covered in **KS3 Science** (n=2767 pupils). Pupils who took part in the lessons were in year 7, 8 and 9 with the majority in year 7 (figure 3). At the follow up time point survey data are only available for years 7 and 8.

Figure 3: The number of participating pupils completing the SEEN surveys by *year group* at each time point



Similar proportions of male and female pupils were taught the SEEN curriculum and completed surveys at each time point (table 3).

Table 3: Percentage of participating pupils completing the SEEN surveys by *gender* at each time point

Gender	Percentage of Pupils		
	Pre-Lesson	Post-Lesson	Follow Up-Lesson
Male	44.1	42.2	45.3
Female	46.5	46.3	45.7
Other/Prefer not to say	9.4	11.5	9.0

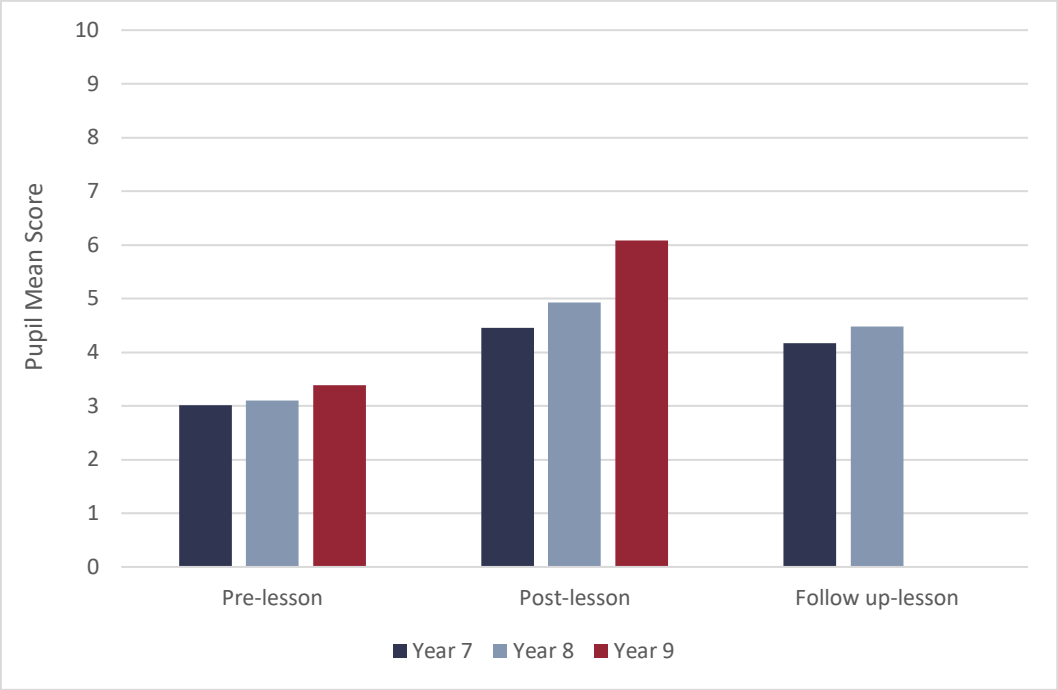
Scientific knowledge

Pupils' scientific knowledge was measured by their answers to 10 multiple choice questions (MCQ) in the surveys at each time point. Mean scores were calculated for each pupil; there was an increase in the mean scores at the post lesson time point compared to the pre lesson time point indicating an **increase in scientific knowledge** (table 4 and figure 4). This increase was consistent when the scores were analysed by gender, year group, class ability and mode of survey completion (online or paper) (table 4). The scores immediately after the lessons and at 6-8 weeks follow up are similar, indicating a retention in pupils' knowledge. This is particularly pleasing given the lack of consolidation, repetition and revision of material content that would normally take place for pupils undertaking a knowledge recall test in school.

Table 4: Pupils' mean scores of multiple choice questions (MCQ) at each time and analysed by gender, year group, class ability and mode of survey completion.

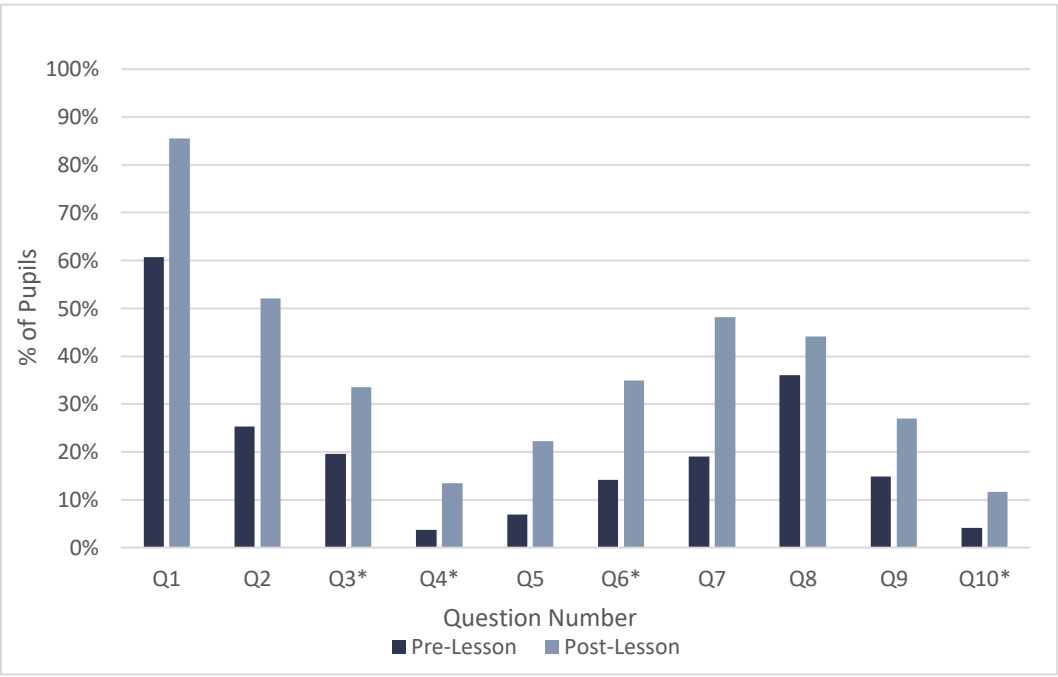
Pupil Category	Pupil Subcategory	Pre-Lesson		Post-Lesson		Follow up-Lesson	
		N	Mean MCQ Score	N	Mean MCQ Score	N	Mean MCQ Score
Combined data	All students	2767	3.09	2056	4.78	1211	4.28
Gender	Females	1286	3.11	952	4.99	553	4.46
	Males	1220	3.14	868	4.69	549	4.10
	Other/Prefer not to say	261	2.78	236	4.31	109	4.28
Year Group	Year 7	1377	3.01	1065	4.45	760	4.16
	Year 8	1048	3.09	808	4.93	451	4.48
	Year 9	339	3.39	182	6.08	-	-
Class Ability Level	High	224	3.96	189	5.92	41	4.92
	Low	93	3.02	51	5.05	43	5.02
	Medium	206	3.13	186	4.53	72	3.62
	Mixed	1157	3.00	784	4.61	762	4.18
	Unknown	1087	3.01	846	4.73	293	4.50
Survey Delivery	Online	1331	3.48	975	5.21	407	4.63
	Paper	1436	2.74	1081	4.40	804	4.10

Figure 4: Mean multiple choice question scores for pupils at pre, post and follow up time points presented by *year group*



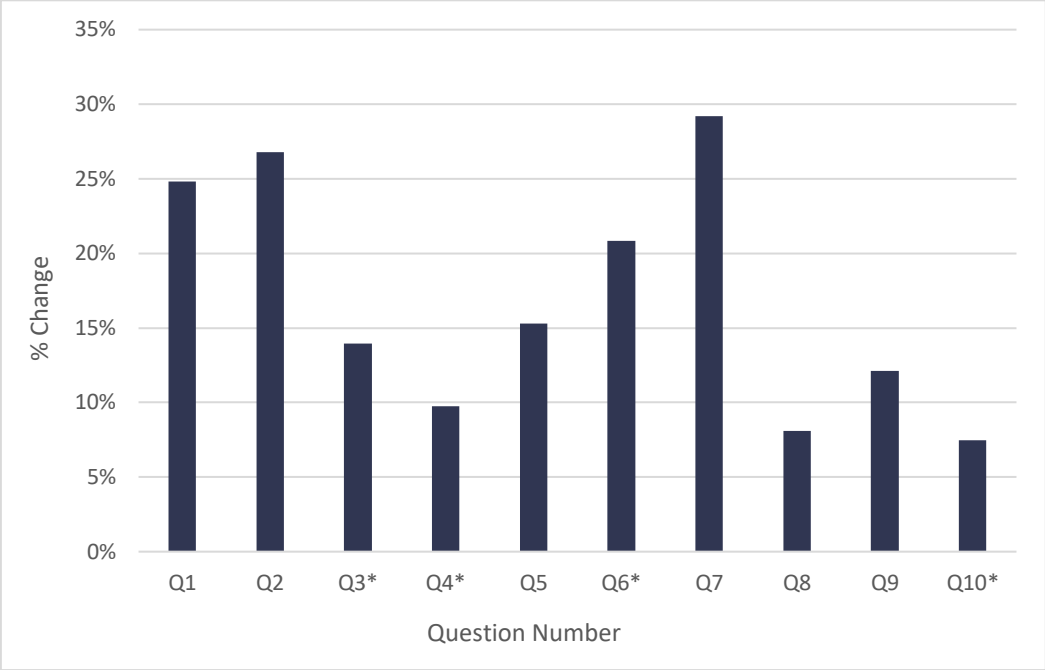
There was also an increase in the percentage of pupils providing correct responses to *each individual* multiple choice question after completing the lessons (figure 5). Some questions required multiple correct answers to achieve a mark of 1 (indicated by *); figure 5 only shows the percentage of pupils that correctly answered *all* the right options (rather than a partially correct answer).

Figure 5: Percentage of Pupils' achieving correct response to each multiple choice question at the pre and post time point



Pupils showed the greatest increase in their knowledge (figure 6) for questions relating to the name of a nerve cell in the brain (Q 1), the definition of neuroplasticity (Q 2), how a caregiver should speak to a baby (Q 6) and the age at which a child's brain is developing fastest (Q 7).

Figure 6: Change in percentage of pupils achieving correct response to each multiple choice question after the SEEN lessons



It is important to note that following the lessons 34% of pupils could identify 3 specific ways a caregiver should speak to a baby (required to score 1 mark; Q6, figure 5), and over 90% of pupils could correctly identify at least one aspect of baby talk ('Motherese'). Nearly half of pupils accurately reported that a baby's brain develops fastest during foetal development and the first two years of life (Q7). However, 80% recognised that the first 5 years are critical for brain development. Over 40% of pupils knew that both genes *and* environment affect child development (Q8), but 80% reported that a child's environment is important for development in the first 5 years.

Application of knowledge

The pupil surveys also included a long answer question:

"*Imagine you are asked to help look after a friend's 2-year-old child for the day. Explain what you can do to support the child's brain development as you play together. Give three different examples. You can write 'I don't know' if you need to*"

Pupils' answers were marked using an agreed marking scheme (see Appendix) with a maximum of 6 possible marks. 0 – incorrect response or 'I don't know'; 1-2 marks for basic comments; 3-4 marks for more detailed comments; 5-6 marks for advanced comments. Answers scoring above 2 marks would reflect more technical skills, knowledge and understanding.

Before the lessons 34% of pupils could not provide an answer to this question and 55% only provided a basic comment. Strikingly, after the lessons over half of pupils provided detailed or advanced

comments which crucially demonstrated they had made the link between practical knowledge and the core science of why these activities were so important (figure 7 and table 5). In total 86% of pupils could now identify at least one way to support a young child's brain development.

Figure 7: Percentage of pupils within each marking bracket for Knowledge Application Question

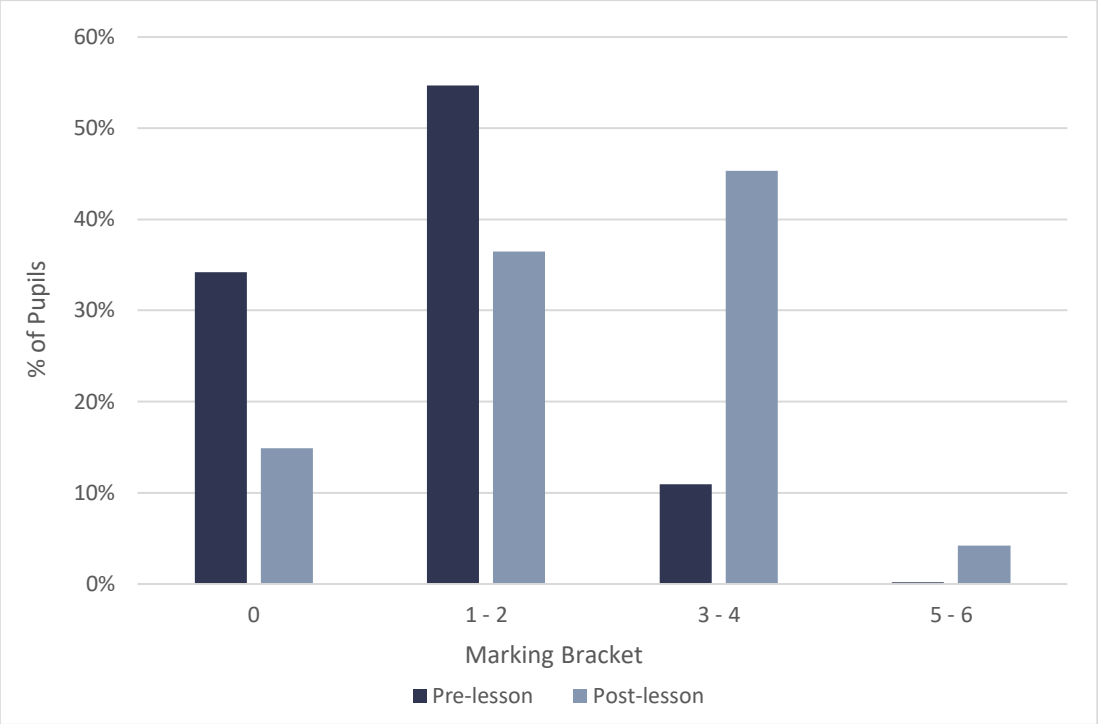


Table 5: Percentage of pupils scoring in different marking brackets. 'I don't know' answers were scored as 0.

Delivery Point	Blank/0	1-2 (basic comments)	3-4 (more detailed comments)	5-6 (advanced comments)
Pre-Lesson	34.22%	54.68%	10.91%	0.18%
Post-Lesson	14.01%	36.28%	45.53%	4.18%

Examples of pupils' higher level responses included:

- *Use eye contact when talking*
- *Speak in a slow voice with exaggerated expressions so that the baby can understand better; repeat and emphasise key words in a sentence to expand the baby's vocabulary*
- *Start by playing how they want to play. Then start narrating your play and telling them the names of the different things they are playing with. Repeat your words slowly and help them by taking turns*
- *I would encourage them to play games with me, taking turns whilst still providing them with the opportunity for self-discovery.*

Results from Schools outside of England

Data from two schools who were outside of England (and following a different curriculum) were removed from the main analyses. Survey responses from these two schools were compared with data from the English schools (n=20 schools; 2767 pupils). Pupils from School One (n=47) had a mean MCQ score of 4.00 and a mean knowledge application score of 1.62 in the pre-lesson assessment. In the post-lesson time point, pupils from School One had a mean MCQ score of 6.16 and a mean knowledge application score of 3.11. Pupils from School Two (n=25) had a mean MCQ score of 3.39 and a mean knowledge application score of 1.46 before the SEEN lessons. At the post-lesson assessment the mean MCQ score was 5.95 and the mean knowledge application score was 2.68.

SEEN lessons delivered in PSHE

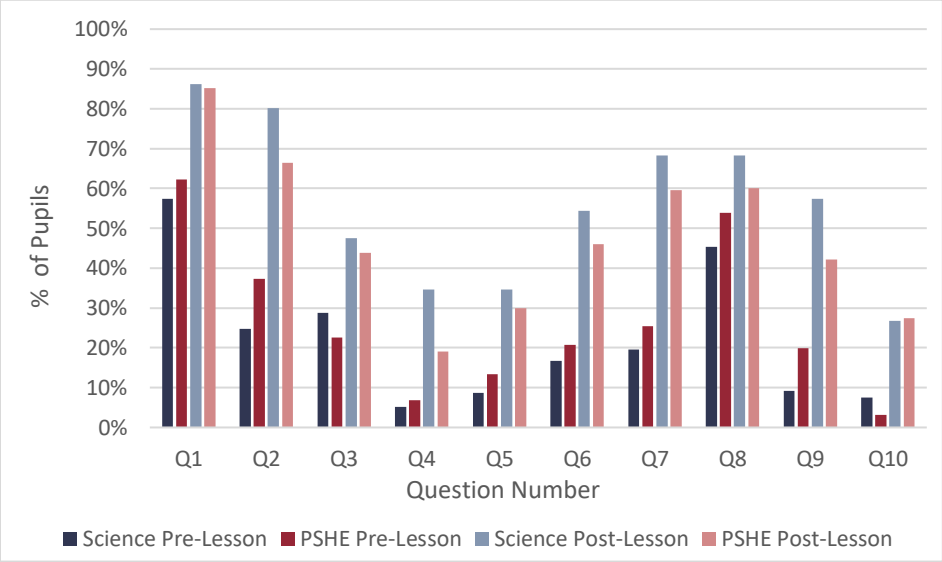
One school delivered the SEEN lessons to year 9 pupils as part of the PSHE curriculum. The comparison between the MCQ scores achieved by the PSHE pupils and Year 9 Science pupils before and after the lessons are presented in Table 6.

Table 6: Comparison of pupils' mean scores of multiple choice questions (MCQ) at each time point for lessons delivered within science and PSHE curriculum

Lessons Delivered in	Pre-Lesson		Post-Lesson		Follow Up	
	N	Mean Score	N	Mean Score	N	Mean Score
Science	174	3.40	101	6.50	-	-
PSHE	217	3.79	230	5.83	293	5.38

Pupils' scores for each individual MCQ were calculated with the red bars representing pupils from the PSHE lessons and the blue bars representing pupils from the Science lessons (figure 8). A higher percentage of pupils from the Science classes achieved full marks on each MCQ after taking part in SEEN, with the exception of Q10 (relating to resilience).

Figure 8: Percentage of Pupils' achieving correct response to each multiple choice question at the pre and post time points



Differences in the change in pupils' from PSHE lessons pre and post lesson knowledge were compared to pupils whose lessons were delivered within Science; pupils who had the lessons within Science showed greater change in their level of knowledge on 7 of the 10 questions, which is particularly notable for Q2, Q4, Q8 and Q9. Interestingly Q2, Q8 and Q9 require knowledge about neuroplasticity and the biology of brain development, rather than the importance of caregiver behaviour.

Application of Knowledge for PSHE classes

Pupils' ability to apply the knowledge acquired from the SEEN lessons in PSHE was compared to pupils who were taught the content with Science lessons (Table 7). There was an increase in the percentage of pupils providing more detailed and advanced comments after the lessons for both Science and PSHE groups, but this was more marked for pupils to whom lessons were delivered in Science. Post lesson, 68% of Science pupils provided more detailed or advanced comments, compared to 55% of PSHE pupils.

Table 7: Percentage of pupils scoring in different marking brackets. 'I don't know' answers were scored as 0

Delivery Point	Lessons Delivered in	0/Blank	1-2 (Basic comments)	3-4 (More detailed comments)	5-6 (Advanced comments)
Pre-Lesson	Science	39%	55%	7%	0%
	PSHE	16.13%	65.90%	17.97%	0.00%
Post-Lesson	Science	5.94%	25.74%	64.36%	3.96%
	PSHE	9.57%	35.22%	52.61%	2.61%

Experience of the SEEN lessons

The post-lesson surveys included a number of questions to explore the feasibility and acceptability of the curriculum content for pupils and teaching staff.

Pupils

A third of pupils reported sharing an element of the lesson content with someone outside of their class. This was similar across self-identified genders (figure 9). The majority (n=496) of pupils stated they had shared this new knowledge with their parent or carer (figure 10).

Figure 9: Percentage of pupils reporting that they had shared an element of the lesson by gender

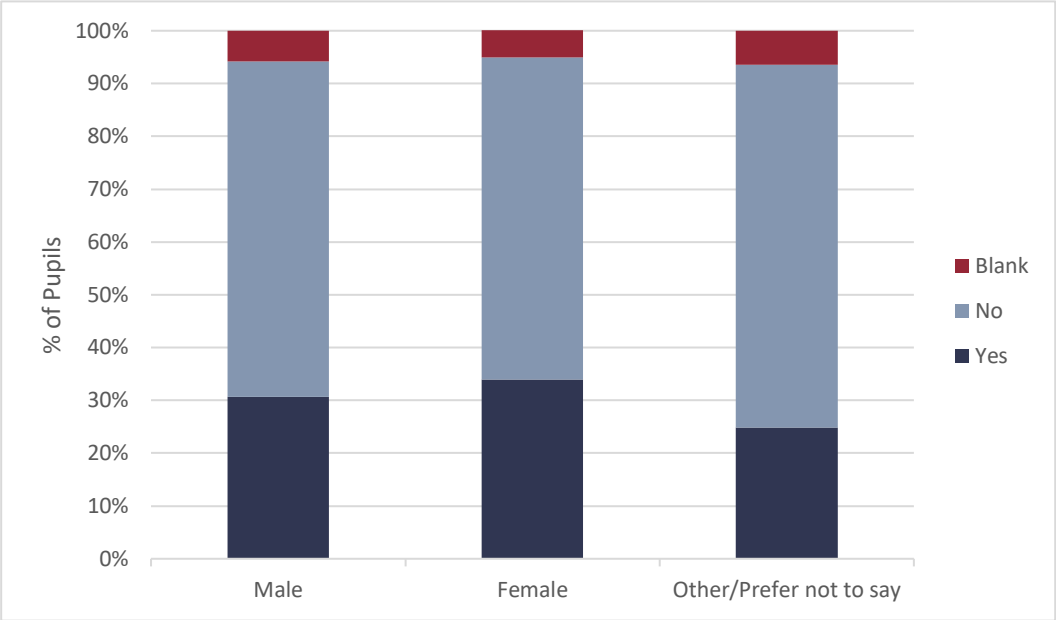
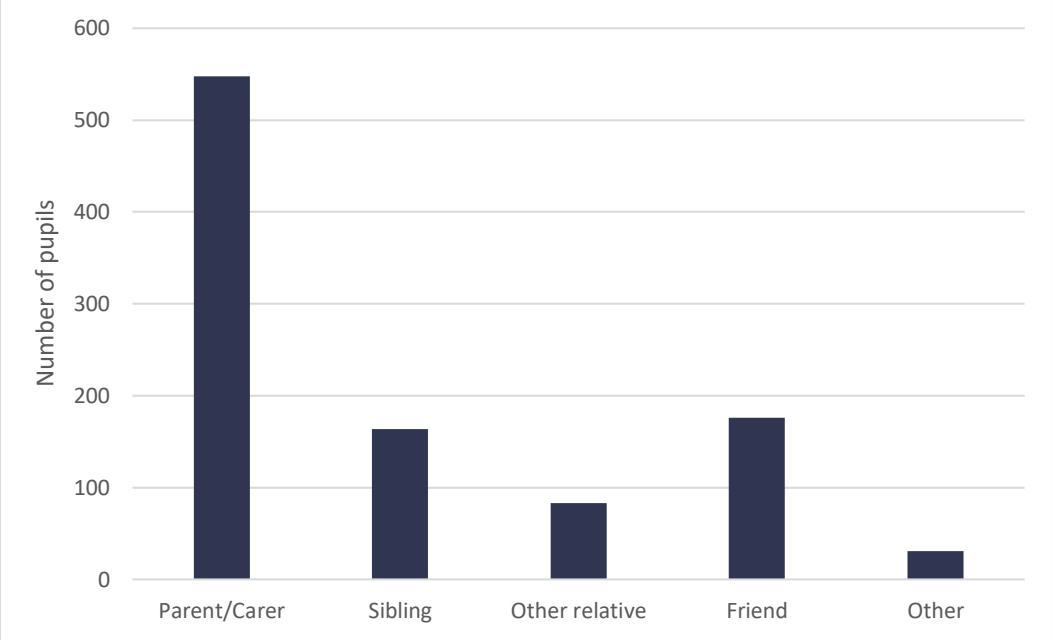


Figure 10: With whom pupils shared their knowledge about the SEEN lessons

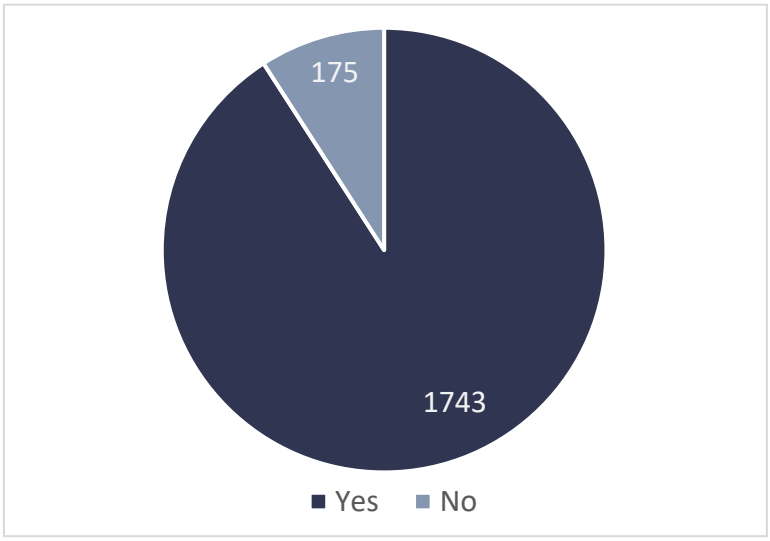


Pupils were also asked to describe the SEEN lessons in three words with the majority using 'interesting' and 'fun' (figure 11).

Figure 11: Word cloud of the most frequent words used by pupils to describe the SEEN lessons

Of the 1918 pupils who answered the post lesson survey question asking if pupils of the same age in other schools should be taught the SEEN lessons, 91% said 'Yes' (figure 12).

Figure 12: Pupils' views about whether the SEEN lessons should be taught to other pupils of their age



Qualitative Results

Pupils were also asked why they thought the lessons *should* or *should not* be taught; themes and examples are presented in Table 8 with the majority of pupils indicating the lessons provided important skills that were relevant for the future.

Table 8: Pupils' rationale for whether the SEEN lessons should be taught to other pupils their age

Yes, this should be taught:

Theme	Example statements from pupils
Important/useful knowledge and skills	*"If you don't do it then you will never get a chance to learn about it."* *"Because we are getting to an age where we need to understand this."* *"Because it teaches new skills and things for life."*
Future relevance (as a parent or carer)	*"We are the next generation and are going to have kids so we need to know how to look after them."*

	"If you didn't know anything about babies and you have one yourself then you could be putting your baby at risk by not meeting the babies needs." *"It is important to know for adulthood."*
Building awareness and changing attitudes around caring for babies and young children	*"It changed my viewpoint on babies."* *"It could have an affect on the way they act around children at home, making a positive impact on the next generation."* *"It educated me on how to interact with babies."* *"It is good for society. It teaches people how to play with younger children correctly."*
Relevant to life now (looking after younger children, interacting with siblings, understanding self)	*"Because a lot of people have regular contact with a young child and this could change the way they interact with them."* *"Because you could have a sibling, nephew or niece that you have a responsibility to look after."*
Importance of brain science, brain development and understanding the mind	*"They can understand how babies' brain develop and how to make sure you communicate with them properly."* *"It is important to know when the brain is most vulnerable."* *"It deepens our understanding of how our minds are shaped."*
Engagement (interesting, enjoyable, fun)	*"I found them very interesting and it taught how to look after young children."*
Everybody should learn this	*"All children should get the chance to learn about this topic."* *"It is important for everyone."*
Relevant for career choices	*"It's important for certain people, for example people who want to work in a childcare environment."* *"They could discover an interest in the topic which could lead to a possible career path."*

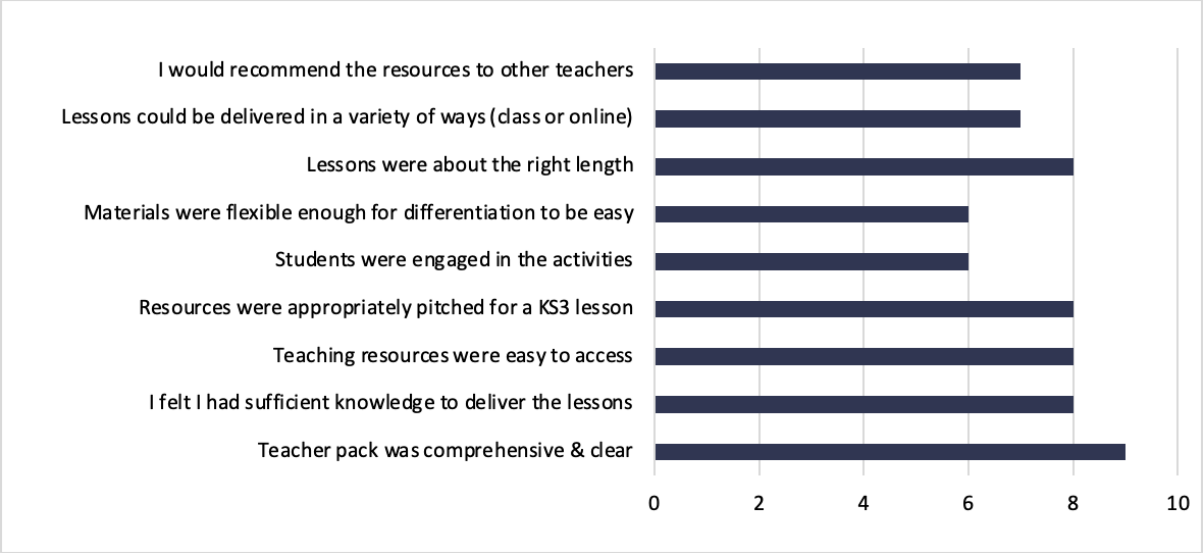
No, this should not be taught at this age:

Theme	**Example statements from pupils**
It's irrelevant or irrelevant to me right now.	*"I don't need to know about the child's brain."* *"We are too young for this kind of thing."* *"We are not parents yet."*
It should be taught at another specified age	*"If we learn it around 15-18 we would remember more for when we have kids."*
It's boring / I'm not interested	*"I found it unengaging and complicated."* *"It's boring and not very educational."*
It's common sense / I know it all	*"They were interesting but it's all slightly self-explanatory you wouldn't leave a child on their own."* *"Waste of time basic stuff you learn when you grow up."*
Other	*"Too hard"*

Teachers

Teachers were asked to rate their experience of the SEEN project materials and lesson delivery using a 10 point Likert scale (10 being the most positive). Forty five teachers completed the survey; all teachers rated the resources and SEEN project as 6 and above (figure 13).

Figure 13: Modal teacher ratings of the SEEN project and SEEN materials and resources

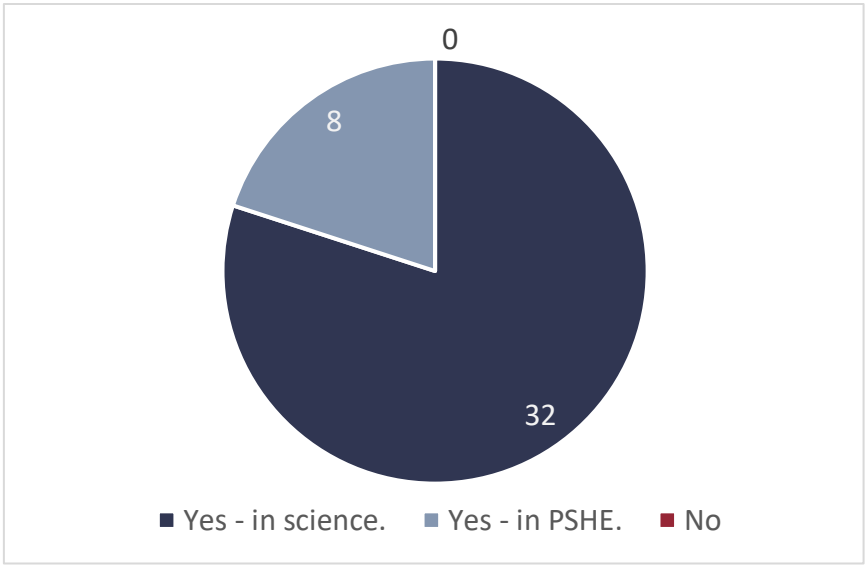


Teachers were asked to rate how *challenging* they found the lesson content for their pupils. The mean score for each lesson was 6 (with 5 being the right level of challenge; 0 being not at all challenging and 10 far too challenging).

Teachers rated each of the 3 lessons for *interest* to their pupils; the mean score for each lesson was above 7 (on a 10 point scale with 0 being no interest at all).

Teachers were asked if they thought brain development during early childhood should be covered in school. All teachers stated that they believed this should be part of the curriculum, with the majority reporting that this should be within science (figure 14).

Figure 14: Teachers' views about whether the SEEN lessons should be taught in school



Teachers were asked to provide a rationale for their response about whether the SEEN content should be included in the school curriculum and in particular, whether this would be best placed within science or PSHE (table 9).

Table 9: Teacher rationale for whether the SEEN lessons should be taught to other pupils their age

Theme	Example statements from teachers
Links to brain science, the mind and resilience	*"Allowing students to understand their own neuroplasticity and how they can improve their own outcomes in life."* *"It is important for pupils to understand and relate to the awareness of knowing how our brain develops in early childhood."*
Strong links to PSHE / some could be taught	*"PSHE allows for more discussion in class."* *"I think both science and PSHE. Science have some subject knowledge; PSHE have more time to play with topics."*
Real world relevance, important and engaging	*"This is a scientific topic that can have multiple applications to real life, students are a lot more engaged when they can see how something relates to them in their life, it has meaning."* *"Fascinating; not covered in depth otherwise."*
Links to psychology (learning, cognitive science, behaviour, regulation)	*"It is important to understand the role as a caregiver and consider the impact of brain development on learning."* *"An understanding of brain development and this can link to learning and metacognition."*
Curriculum links within science	*"It should be linked to the science curriculum then it will be taught as part of the national curriculum."* *"It would fit in well to the science curriculum at key stage 3"* *"It links to reflexes and introduces neuron development."*
Future relevance (as carers, life decisions etc)	*"Knowing the importance of events in early childhood may alter some people's behaviour down the line."* *"Too many people become parents with poor parental role models. Children could have a better start to life if their parents understood the value of positive interaction between parent and child."*
Important to have a science specialist teacher	*"Science specialists are knowledgeable of the science. PSHE is taught by a mixture of teachers, many without science background."* *"There is a lot of biology in this topic which would be harder for non-scientists to answer questions on."*
Barriers to science	*"The content in science is already overloaded and pressure to deliver what is there is already high."* *"Sadly too much content to cover as it is!"*
Inappropriate for pupil age	*"Useful knowledge later in life for new parents, not for children at KS3 level."*

Seven teachers reported that a pupil within their class had raised a concern about the relevance of the material covered to their own childhood experiences. Three of these pupils were aware of adversity within their own early years and were fostered or adopted; one pupil was currently a Young Carer and two pupils had experienced a bereavement within their immediate family. The teachers' responses indicated that they felt able to manage their pupils' questions or concerns and had stressed the ongoing importance of neuroplasticity, particularly during adolescence.

Teachers' qualitative feedback

Eighteen teachers participated in focus group discussions, and 45 completed qualitative sections of the post-lesson surveys. Fourteen pupils participated in focus groups with their classmates. These offered an opportunity to explore teachers' and pupils' experiences of the SEEN lessons. The following themes were identified:

1) Inspiring curiosity – staff and pupils were excited to be learning new content around brain development and the carer's role. The lessons were 'different', prompted discussions and questions, and inspired both teachers and students to want to find out more.

"I really love the lessons. They were super engaging with the students and when I found out about the lessons, I was excited as well because I found them a bit different from the regular lessons that we normally hold. But then I could see it with the students as well. They were super engaged. The content was something different. Something new. Yeah, the questioning that was happening in the classroom was fantastic." [Teacher]

2) Relevance – participants felt that the content and skills were relevant to their role as carers now (teachers, parents, siblings, babysitters) and in the future (as parents, carers or in a relevant career). Teachers commented on the relevance of the content to timely issues in education such as cognitive science and learning theory, pedagogical approaches and mental health and wellbeing.

"it's really beautiful because they started telling me stories as well of what they did with their siblings etc. And how they did observe the same things… and then we put a scientific concept content to it." [Teacher]

"they come from quite large families and I think there were like 'hold on a minute actually. Maybe my little siblings aren't just annoying me for hell of it'. They're actually kind of looking at it going 'Oh, actually, maybe that is why they do that. And maybe actually, I shouldn't get so annoyed with them and I should interact differently." [Teacher]

3) Context specific sensitivities – teachers provided examples of specific students or contexts which were relevant to the content of the SEEN lessons, such as bereavement in the early years of life, living in care or difficult experiences. Whilst these sensitive issues raised questions from pupils, teachers felt the experience was overall worthwhile and endorsed the continued teaching of the content.

4) Barriers: the 'usual suspects' – teachers and pupils were both asked about challenges or difficulties they might have experienced around the lessons. However, comments were limited and to the 'usual suspects' that are often cited by teachers when changes in curriculum are being introduced including: "*too much content to cover as it is!*" "*don't have the depth of understanding*" or "*didn't feel it was appropriate for their group".*

5) Ease of implementation – there were extensive comments about the ease with which "*the ready-made lessons were picked up and slotted into existing curriculum plans*". One teacher used the analogy of the project being "*like a fisher price toy - you pick it up and immediately know how it works*."

6) Changing minds, attitudes and behaviours – this theme illustrated the wider impact of the project, in particular spreading the message with families.

> *"I told my mum's friend who's a childminder about baby talk, over exaggeration, and she's been using it on kids she needs to look after."* [Child]

Teachers also noticed a shift in pupils' attitudes towards babies, caring roles e.g gender, and understanding of their own personal experiences. For instance, on gender, teachers felt "*it's important for challenging societal norms - that being the caregiver is the females role rather than the males.*"

Pupils talked about how they interacted differently with babies as a consequence of the SEEN lessons "*I can use baby talk with my new baby cousins that's just been born*" and teachers noticed that "*they (the children) were gobsmacked that putting a child down in front of a TV was not a suitably interactive... they didn't realise this wasn't a sensible option*".

Teachers also mentioned changes to their teaching practice, one commented "*it* definitely *informed my planning for future lessons*". Another teacher felt it changed their relationship with a pupil they previously had *"no background for…"* saying he was "*really brave"* in sharing some experiences which implied new insight.

7) Longevity – many teachers showed a clear commitment to teach the curriculum content again in the coming academic year, others said they *"want to keep it in the scheme of work going forward".* Teachers suggested ways in which the materials could be adapted to maximise the impact of the curriculum content for pupils. These included reference to cross-curricular links, e.g. with personal, social and health education; adaptations for different age and ability groups and approaches to teacher training.

Conclusion

The SEEN Oxford project has successfully taught over 3700 pupils the importance of neurodevelopment in the early years. The 3 lessons have improved 11-14 year olds' knowledge about the neuroscience of the first 5 years; pupils' new understanding is also manifest in their practical ideas about how to support children's brain development for life long health.

This project has shown that it is possible to engage pupils and teaching staff with these concepts and implement new curricula into existing school timetables. The results have the potential to improve outcomes for future generations. We propose that this new knowledge should be consolidated at later time points during education, professional training and perinatal education, with the aim of establishing a community wide understanding of the importance of the early years.

Acknowledgements

The SEEN project team would like to thank all of the schools, teaching staff and pupils who took part in the project; we are hugely grateful for your enthusiasm, commitment and collaboration. We are extremely grateful to the expert groups who provided their wisdom and experience to make sure the curriculum was accurate and implementable. Finally thank you to the generosity and support from Kindred² who commissioned and funded this important piece of work.

Appendix

Multiple choice question (MCQ) marking scheme

Pupils could score a maximum of 10 points in the 10 MCQs in the survey with each question being worth a total of one point. Each question had five or six potential answers including 'I don't know'. For questions which had one correct answer, selecting the correct answer and no other options gave the participants a score of one for that question. Questions 3, 4, 6 and 10 had multiple correct answers and were scored proportionally. For all questions, if a participant selected an incorrect answer, they received 0 points for that question.

Q3

- Selecting option b = 1 point
- Selecting option d = 0.5 points
- Selecting option b and d = 1 point

Q4

- All options apart from e (I don't know) were correct, so pupils received 0.25 points per correct option selected. Therefore, if a pupil selected all of the correct answers, they would achieve 1 point for question 4.

Q6

- Options b, c and e were correct. Each answer was worth 0.33 points giving the pupil 1 point if they selected each correct option and no others.

Q10

- All options apart from e (I don't know) were correct and pupils received 0.25 points per correct option selected. Therefore, if a pupil selected all of the correct answers, they would achieve 1 point for question 10.

Short answer marking scheme

The short answer question in the survey was used to assess pupils' application of knowledge and was marked using a scheme that divided responses into 3 mark brackets, with a maximum score of 6 (0-2; 3-4; 5-6).

0-2 marks	**3-4 marks**	**5-6 marks**
Appropriate basic comments made (see examples below)	At least 1 appropriate detailed comments made. (see examples below) or a correct explanation of why something is being done.	3 different detailed comments given (or 2 very advanced level). These are likely to included explanations of why something is done. OR an indication that the child has understood a broad range of topics covered in the lessons.
0 marks if only 1 basic comment given	3 marks – 1 or 2 with detailed comments.	5 marks - at least 2 refer to advanced levels of knowledge (see points below)
1 mark if only 2 comments given.	4 marks: 3 detailed comments made. One comment may include advanced language e.g., baby talk. Or a link to why you are doing something.	6 marks = All three comments have advanced explanation or language.
Keep at 2 marks even if 3 comments made, but all at basic level.		

Examples of basic comments (1-2 marks):

- Talk to them
- Feed them
- Take them to the park
- Make sure they are safe
- Play games with them, like puzzles or blocks.
- Speak clearly and slowly
- Hand gestures
- Not counted: vague comments like, look after them,
- Repeated items counted as 1 entry e.g. teach them to speak / teach them some words

Examples of more detailed comments (3-4 marks)

- Point at the pictures as you read the book
- Repeat words
- Speak with a sing song
- Baby talk (on this and advanced)
- Something that indicates child led e.g. 'do stuff they want'.
- Join in with imaginary play
- Pay attention
- Eye contact
- explanation e.g. increases vocabulary
- Labelling

Examples of advanced comments (5-6 marks)

- Child led activities, follow their lead
- Serve and return type interactions
- Detail of baby talk e.g. exaggerated facial expressions, sing song voice.
- Detail of brain development e.g. plasticity, networks or foundations.
- Exposure to new experiences linked to learning or resilience.
- Avoid electronics and encourage interaction (develop social and communication skills)

Interview guide for Focus Group Discussions

1. What has been your general experience of teaching the lessons? Why? What impact did it have? Did you find it helpful? What was helpful? Preparing the lesson?

2. How did your class respond to the lessons? Why? How do you know this? What sort of things were they saying that would give this impression? Probe whether there were differences in the response of particular groups (e.g. by ability or age) and any surprises.

3. How did you feel about teaching this material? Explore any specific experiences or interests that may have contributed to their answer.

4. How about the experience of your colleagues? Why? Explore if similar or different experiences amongst colleagues either from staff perspective (experience of delivering lessons, teaching this material) or perception of pupil response to lessons.

5. Wording will slightly depend on what has been discussed already: 'Any thoughts about what contributed to the success of the lessons, or conversely, made things difficult or needs to be addressed?' (This might be your, your department or colleagues' experiences). Why?

6. How did you feel about the training for teachers delivering these lessons? Was it helpful? What was helpful?

7. Would you say there was agreement in your department about teaching this content?
8. If relevant: I know you were the only / one of a small number of teachers who taught this in your school. What is the reason for not teaching it to the whole year group?
9. Can you tell me anything more about the suitability of the content for your students?
10. What would you have said is the main thing that students took away from the lesson?

Additional questions if time:

1. Would you teach this content again? Why? Would you change anything? If so, what?
2. Was there additional content that you felt should have been in the lessons? Why?
3. What age group do you think the curriculum content is most appropriate for? Why?
4. In the survey you were asked about the content being taught as a standalone unit versus spread over different year groups and curriculum areas. What do you feel about this? (or explore further their responses to this question in the survey).
5. In your feedback you talked about XXXX I wondered if you could say a little more about this?

Before we finish for you to ask us any questions you have. Is there anything you would like to ask us?

Participating schools

Anonymous

Bexhill High Academy

Colne Park High School

Devizes School

Gillotts School

Harrogate Ladies' College

Jerudong International School

King Alfred's Academy

Laurence Jackson School

Lawrence House School

Millais School

Nower Hill High School

Prestfelde School

Sandhill View Academy

South Charnwood

St Leonards School

St Peter's Catholic School

Torquay Boys Grammar School

The Holmesdale School

The James Hornsby School

The Oratory School

The Reach Free School