

Measuring 4, 5 and 6 Year Olds' Financial Capability: Summary of Workshop Discussion

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We would like to thank Judith Staig of ContentWrite for putting together this summary of the Measuring 4,5 and 6 Year Olds’ Financial Capability workshop discussion.

1. Introduction

Money and Pensions Service (MaPS) wants to better understand how to measure financial capability and meaningful financial education for children of four, five and six years of age and their primary carers. This more in-depth understanding of what is suitable/possible with this age group will, in turn, inform the Financial Foundations Agenda for Change which is part of the ten-year UK Strategy for Financial Wellbeing. The National Goal for the Financial Foundations Agenda for Change is that two million more children and young people aged five to seventeen receive a meaningful financial education by 2030. However, at the moment, we are not able to measure this National Goal for the entire age range of five- to seventeen-year-olds, and only for the seven- to seventeen-year-olds.

Measuring financial capability in younger children is an area that we have been working on for a number of years. In fact, the first ever survey of children and their parents/carers to better understand the financial capability of children and young people, the MAS 2016 Financial Capability Survey for Children and Young People, included children aged four to six. These children were included as a trial to see if surveying such young children about such a complicated subject area could work. After looking at the results in more detail we decided more understanding was needed before trying to measure with young children again, so in 2019/20, we undertook some qualitative research exploring what financial capability might mean and look like at a young age (four to six) and began to think about ways in which that could be measured.

The goal of this workshop with Subject Matter Experts was to understand what is possible in terms of measuring and recording financial capability and meaningful financial education for children of this age group. This will put us in a better-informed place to design a UK wide research project for the measurement of financial capability for this age group.

We invited participants with a wide range of complementary expertise and different perspectives to a 2.5-hour workshop to discuss the following questions:

1. What research questions can and should we be asking children in this age group?
 - a. How does children's development inform what we can ask?
 - b. How does the context of children's financial socialisation affect what we can ask?
 - c. What are some of the differences in capabilities by age that we need to accommodate?
2. How can and should we be asking our research questions?
 - a. To what extent should we include each target group: parents/carers, children and teachers?
 - d. How can we measure financial concepts in a research setting?

The workshop was held virtually on 8 March 2021. The remaining part of this report summarises the discussion from this workshop.

2. The What: What research questions can and should we be asking?

In the first section of the workshop, we asked what sort of questions we should be asking, to measure financial capability in this age group, and what sort of questions it is possible to ask given children’s developmental stages and experiences.

2.1. Understanding young children’s development more broadly

The discussion started with a broad question about children’s development and how that would relate to money skills. Within that overarching question, we started the workshop by asking about how children’s values and beliefs develop. The discussion expanded to look at the impact of other aspects such as emotions, confidence and personality.

2.1.1. Aspects of development

Participants thought that at this young age, it is hard to separate the values and beliefs of the child from those of the parent, and that older siblings also played a role.

ND: “It’s around three they start to take a lot of interest in not even necessarily playing with other children but observing other children.”

Children’s emotions are also important in that they can drive behaviour around choices and other economic activities.

ND: “A child’s world from birth is emotional. Throughout development this emotion matures into cognition and behaviour (including financial behaviour). It is advised to explore their financial capability from this emotional world – very young children are unlikely to conceptualize money above or beyond how it makes them feel (losses and gains). I would theorise this would possibly be the most important development stage (emotion to cognition/behaviour) to understand when examining the development of financial capability.”

The discussion moved on to the idea of confidence; learning itself is related to confidence, and that how confident parents are around money is likely to have a substantial impact on how children learn.

EK: “Learning is mediated massively through confidence... and the vector through which children are likely to get the majority of their exposure when they’re small, is through parents and the home environment. That makes me think about how confident parents are and their own anxieties that can get into this topic... To speak to their kids about it, they reflect on their own position, which then generates anxiety and then it shuts the process down.”

SM: “Confidence... really does relate to an emotion component of our relationship with money... that is also worthy of being explored, because it does influence, not only the actual concepts [associated with money], that tangible understanding... but the emotional context [which] is equally as important.”

Confidence and self-efficacy play a part not only in how children behave around money, but also in how they respond to questions. We need to be careful that children aren’t giving the answers that they think the adults want to hear, rather than those that reflect how they would really act. For example, a child might know that it is good to save their money, but still want to spend it all at once.

Another factor that will influence how children think and behave is personality, one element of which is time perspective, which can be impacted by numerous factors such as culture, family, and level of education. (See appendix A for further information.)

ND: “Whether a person is present orientated versus future-orientated will impact how they handle money. So, someone who is present fatalistic can be quite hopeless and might not have confidence around money, versus someone who learns from the past.”

This is related to ideas about delayed gratification, the degree to which it can be measured, and the degree to which it predicts other outcomes. The original, well-known Stanford marshmallow experiment has been hard to replicate in recent years. However, another study in New Zealand, the Dunedin study (see 5.3 Recommended reading), has shown self-control to be highly predictive of adult outcomes, so this is a dimension that needs to be considered. It would be helpful to see if the research instruments and measurement approach from that study are available¹.

One possibility may be to find out whether and how the parents support a child’s capacity to defer gratification.

AS: “There’s a gradual developmental shift towards being able to deal with longer and longer delays. And that’s the bit that parents support.”

Focusing on elements such as children’s confidence and how they emotionally relate to gain or loss, and looking at concepts such as time, delayed gratification and other potential aspects of personality will allow MaPS to approach this measurement exercise from a much broader perspective than trying to understand more narrowly defined financial literacy or whether children understand where money comes from.

There were two additional factors which were mentioned following the workshop discussion as part of the input into this summary. These were:

- a person’s style of attachment (attachment theory)
- the concept of locus of control

Attachment theory says that our style of attachment is formed at a very young age and can, in part, explain many of our behaviours and choices as both children and adults. While attachment theory has traditionally been used to describe interpersonal relationship dynamics, it is increasingly being recognised that a person’s attachment style also impacts other relationships – including relationship with money.

Locus of control (LoC) is the degree to which people believe that they, as opposed to external forces (beyond their influence), have control over the outcome of events in their lives. Understanding what the evidence says about its role in financial capability (i.e., financial locus of control) and how MaPS can consider the parents or carers’ LoC, and how it may be reflected in how they talk to or teach children about money management, will be important.

Further information on the four core styles of attachment and the different types of locus of control and its implications on financial capability can be found in Appendix B.

2.1.2. Economic concepts

One of the most important ideas that was discussed was that children can understand economic concepts without understanding about money, and without having to link those concepts to money. This is because understanding various economic contexts and understanding money are likely to be quite separate for children in this age group – this is ‘piecemeal’ learning which is observed in other domains of a child’s development as well. For example, children in the playground know about ‘this is mine and this is yours’ from a very early age, and can understand

¹ However, the Dunedin study uses a composite of multiple measures administered over several years, so might be difficult to apply here (AS).

concepts such as rewards, give and take, and borrowing or stealing.

PC: “Every decision that we make, including in the playground or in the classroom has something to do with the basic concepts of economics. So, scarcity, choice, constraints... decisions, trade-offs ... the concept of time and so on.... we view economic literacy as a much broader thing, which helps because we can start at a younger age because you don't have to be in charge of the purse or the budget or have to actually transact in order to understand the concepts.”

ND: “Undirected play allows kids to learn to work in groups, share, negotiate, solve problems and learn self-advocacy, all of which are critical components of financial capability.”

PC: “If you tidy up your toys, you get the biscuit. That's really just understanding that idea of give and take, that there are consequences. Those are economic concepts that are easy to build into what they do already, and those are the foundations of things that will later be ‘if I do my job, I get my wage.’”

The participants felt that children aged four to five are likely to know many things relating to money, such as what it is, and that you can spend it in a shop, but without necessarily being able to understand why. They may also not be able to put those separate things together so that they understand, for example, that people get money by working and then spend it in shops to get food. This ability to link these ideas is developing as children get to age six and older. The idea that children’s understanding develops piecemeal is key to these discussions and is addressed in more detail in 2.3 Differences in capabilities between four-, five- and six-year-old children.

TJ: “So a four-year-old might know that shops are where you get things, but they don't necessarily understand the links between shops and money. And they know that money is for paying for things, but they don't know where money comes from or why it is we use money. So, they understand some of these things as unconnected behaviours... and this is what's developing through six and seven years old.”

This inability to link up ideas about money, and piecemeal development of understanding more broadly, coupled with the fact that parents sometimes shield children from some aspects of learning about money – such as its scarcity, or that it is a finite resource – may lead to children having misconceptions about money. For example, some children may think the ATM is a ‘magic money tree’ or the ‘factory’ where the money is made. Observing play can help us to understand how they are putting these ideas together.

AS: “Children act their understanding out in their play, not just based on what they observe, but this may also include elements they merely inferred, to make sense of what they saw... [For] example... a child observing a parent at the cashpoint and the child linking this, in a conversation later, with their idea of a factory where you make things. The observation left a question in her mind where the money came from, but rather than linking the cashpoint money context to other contexts in which she had encountered money... she linked it to a factory context and ideas of physical things being produced.”

AS: “When a very small child loses their few pennies, the parents are very likely to just replace it... so they might be getting slightly different messages than older children... Maybe that's where math can come in because... a number is there, and then you take away from it [resulting in less]. You don't have that in the [money domain for small children] so much.”

2.1.3. Numeracy

The idea of separating economic concepts from money prompted discussions of numeracy. Numeracy is certainly part of financial competence but in children of this age, the participants felt that there was a need to separate numeracy from money. Children may have a good sense of numbers, but money involves understanding the concepts of units and decimals which are typically not taught in schools until KS2. Participants pointed out that money is not the only currency.

AS: "If it's too much about money, that's actually obscuring their understanding. There are alternative currencies... the first universal one that operates in the playground is stickers... They will do almost anything for stickers. A sticker is also a countable, concrete, perceptual object that has value in itself, through being decorative."

PC: "You don't have to think about saving in terms of money, just in terms of 'if I have a certain amount of food, am I going to eat it right now or should I save it for after I play?'... We don't want a survey to be picking up just math skills or just understanding of money. We're trying to do something more holistic than that."

Separating understanding maths and numeracy from understanding money would help again here to ensure that we are measuring the right thing.

2.1.4. The need for a holistic approach

Overall, these ideas point us to the need to take a holistic approach to understanding financial

capability in children, by looking at the full range of factors discussed so far: their understanding, confidence, emotions, personality, time perspective, behaviours and exposure/ experience of a wide range of early economic activities.

Given that children are not necessarily linking skills and knowledge about money together, it also points to a need to simplify questioning, to only ask about one aspect in each question, so we can be clear about what we are measuring.

SM: "I'm taking a much more holistic approach... I'm very much of the mindset that we are aware that children and young people, adults, we are all developing our concepts... through what we would refer to as experiential learning."

TJ: "The bits of the brain that deal with spatial awareness might have their growth spurt at one time and then the language parts develop at another time and all these skills are developing relatively independently... there's these different foundational skills that will contribute to children's economic understanding at some point, but [we need] to try and develop ways to measure these things relatively independently. So, deal with children's understanding of the social contracts separate from their understanding of the relationships between numbers.

Because otherwise, if you're trying to measure too many things in one set of questions, then you may not be really getting at the separate skills that you're looking for."



For example, this question from the previous study, that may have been hard to interpret, highlights the need to separate economic concepts from numeracy and understanding of money. The question is not only asking children to recognize the value of the coins, but also to add them up and then to link them to the cost of the lollipop: a lot of skills in one. One of the participants questioned the decision to make the coins the same size, when in real life they are different, which was an attempt to focus the child on the numbers on the coin, and to minimize the impact of larger being thought of as more valuable. However, without an understanding of units and decimals, this may still have been confusing for children.

2.2. Understanding financial socialization and children's economic activities

Another of the most important ideas that was discussed was about children's activities. We also cannot understand financial capability in young children without considering their financial socialisation and their early childhood consumer experiences which, research suggests², have

a significant effect on the financial well-being of adults.

2.2.1. Economic activities

In the same way that financial learning is about more than money, the experiences that children have that would help them to learn about finances are also not necessarily related to using money. This means it is important not to discount the experiences that children have in settings outside of the family, such as nursery or school.

NE: "In preschool environments, children using a till or coins or a shop... that's a very good basis for these young children developing their understanding of 'we go into a shop and we pay for an exchange of goods' ... a lot of schools have reward charts and systems ... And children at a very young age, they do understand that... it's not using money, but it's exchanging something for something."

²

<https://www.frontiersin.org/articles/10.3389/fpsyg.2020.02162/full>

2.2.2. Socio-economic and cultural background

One of the key issues to be mindful of when thinking about children’s activities and opportunities around learning about money is the socio-economic background of the family. Children in more affluent middle -class families benefit from more exposure to opportunities to learn, and also from parents being more confident about money.

TJ: “In more middle-class homes, children are able to talk about the household economy. So, they know what their parents do for work, they know how much things cost, they go to the supermarket with a parent... They're also much more likely to get regular pocket money and be encouraged to save. Whereas children... in more deprived areas of the city, they often don't know what their parents do... They don't know how much things cost; they don't go to the shops. They're not involved in the economy of the household. ... Also, parents in more deprived families don't recognize the fact that they're really important for their children's education and they just don't feel like they have anything to offer.”

It is also possible that children from more deprived backgrounds will have a heightened awareness of money because it will be a prominent topic in parents’ conversations, and they may be aware of scarcity, or of unpredictability of income. In any case, it will be important to pay attention to the context of the child’s socio-economic background.

TJ: “Children in the more deprived areas get more money to spend than children that are in better off households. But it's very unpredictable when they're going to get it, it's not so regular or stable, so that on its own leads to less saving behaviour because they don't have that regularity... also if they don't spend it straight away, then it may get borrowed back... it might be quite difficult to separate what's physically possible for children in their homes or what's possible for parents, away from what they

understand and how they might behave in an ideal world.”

ND: “We often assume that low socioeconomic status is associated with low financial capability. In fact, some children may have a better understanding of money, developing skills from helping their parents calculate during shopping or watching their parents save to be able to afford school necessities or Christmas gifts, etc.”

Family culture and cultural norms around money will also have an impact.

ND: “There are some cultures where the money the child gets will go on something they want. There are other cultures where the money they get, say from a part-time job, would go back into the home and back to the parents.”

2.2.3. The impact of social changes

Social changes also have an impact on what children are able to experience. Society is becoming more digital and cashless, which means that children are less likely to see cash being used. As transactions become increasingly contactless, it becomes harder to observe parents using debit or credit cards. And Covid-19 has led to many other changes, such as it being less likely for children to be visiting shops, and less likely to handle money, for reasons of hygiene. This is making money less tangible and potentially making it harder for them to have a sense of what money is, which they will need when they do start to make connections between economic concepts and the concept of money. This may be even more of a reason to focus on economic concepts as separate from money and currency.

ND: “We've become a contactless society and money is disappearing from the home, especially with COVID. Children are being told not to touch money in the shop because of germs. How parents view touching money is changing and children just aren't seeing money as much. Since children like concrete concepts, this societal change could have a huge impact on how

we teach financial capability – and how children learn about it.”

AS: “kids used to play shops a lot but may play shops less now that they don’t physically go there so much anymore. In contrast, they may start to play buying stuff online (e-transactions), choosing something, clicking buttons, and eventually getting a package at the door, and we will see whether there is any place in this for payment and how they make sense of this and how and whether they link it to other money contexts.”

SM: “[There is existing research ³ which] suggests that children’s online shopping behaviour is influenced by parental behaviour. In addition, children’s age, peer group and social media are influencers. [This] suggests that parental and peer-group consumer behaviour and exposure to social media during pandemic lockdown would be likely to influence children’s perception and behaviour.”

Being mindful of the issue of context, the participants felt it was important to get a baseline understanding of the types of experiences around money, finances and economic concepts such as saving or borrowing that children have had. It is easy to assume that all children are going to the supermarket with parents, but that may not be the case. Some new activities may have also entered the list of relevant experiences, such as receiving a parcel from Amazon or having groceries delivered to the door. They also expressed an interest in asking both parents and children about these experiences, to see if there was a disconnect; parents may believe that their children see them paying with money in shops, but the children may not be engaged or aware of the activity.

EK: “We could just ask questions like, ‘Have you ever been to a supermarket, had shopping delivered to your house, seen an Amazon parcel?’ ...and we could mix it in

with a whole load of real-life activities that we think small children might do... such as go and post a letter.”

The other aspect of experiences around money that it will be important to ask is whether children have any money of their own, and the degree to which they have control over that money.

TJ: “Quite a few children in this age group will have experience of having an amount of money they get to make a decision about... money from birthdays, Christmas, and they’re allowed to spend that in a shop... some children will have that opportunity and some children... they’ll be having their decisions made for them... also at this age... a number of children are getting regular pocket money... whether they spend that every week... or whether they choose to save part of it.”

2.2.4. Context is key

As well as the need to take a holistic approach to understanding financial capability in children, by looking at a full range of understanding, knowledge, attitudes, and behaviours, as discussed above, this section shows that it is crucial to also understand the child’s context and background, and the experiences they may or may not have had. For example, asking children to choose whether they would save or spend, or whether they would buy food, or a toy is dependent on not just on that child’s understanding of economic concepts, but also on context. Are they hungry at that moment? Is there a particular toy they are craving? Do they have many toys at home? Do they see food as something that just arrives rather than needing to be bought? If they don’t spend their money, will it be borrowed for household necessities? Do they have anywhere safe to save it? One way of tackling this is to use a story-based approach, discussed later in [Section 3.2 How to measure in a research setting](#).

³ Thaichon, P. (2017). Consumer socialization process: The role of age in children’s online shopping behaviour. *Journal of Retailing and Consumer Services*, 34, 38-47.

ND: "Taking a holistic approach is going to be a great framework for this project. It is important to look at a child's financial capability from a social perspective, a cognitive perspective, an emotional perspective."

A further aspect of interest is the degree to which children of this age can distinguish between needs and wants, an area which the participants didn't

feel that there was conclusive existing research, although NE mentioned a national curriculum resource that covers this topic,⁴ and AS referenced another paper that found a distinction only after age six⁵.

This discussion brings to mind an example of a question used in the previous study that may not have been measuring what we hoped it would. There are many reasons that a child may choose a toy over food.



Can you help me? I only have £5 to spend and I am hungry. I can spend it on a new toy or on lunch. Which should I choose?



Toy



Lunch

⁴ <https://www.young-enterprise.org.uk/teachers-hub/financial-education/>

⁵ Rizzo, M. T., Elenbaas, L., Cooley, S., & Killen, M. (2016). Children's recognition of fairness and others' welfare in a resource allocation task: Age related changes. *Developmental psychology*, 52(8), 1307.

2.3. Differences in capabilities between four-, five- and six-year-old children

It is difficult to be specific about differences between the age groups, as children develop at different rates, and there will always be difference between children in the same age group, not only in terms of development and ability, but also in terms of learning style. This speaks to a need to make any research as broad and inclusive as possible.

AS: “It’s almost always dangerous to talk about children having an understanding or not having an understanding of anything, because understanding is something that grows much more continuously, typically over many years... [Cut-off points are] quite arbitrary... [understanding] grows from many directions at once. It’s not necessarily integrated at first. And it’s a very slow process.

ND: “The same questions need to be presented in different ways for the questions to be accessible to all children. This will also help control for the different capabilities between 4-, 5- and 6-year-olds. The more visual child will be drawn to pictures, whereas the more auditory child may prefer to listen to the questions. Still, other children

may be more responsive to touch and presenting answers by, for example, touching the number of 1p coins that equal 5p. Having said that, it is possible to draw some distinctions. For example, children of five and six will have experienced a school setting and be working with the national curriculum for that age. Children of four may or may not be in an early-years or a reception setting outside the home. It will be important to understand what is currently taught and assessed as part of the national curriculum and what the milestones and expected skills are for those ages, not only around maths and numeracy but other elements of development that relate to economic activities.”

PC: “there’s a huge amount that we can actually do around economic understanding and literacy... within the curriculum already... including US programmes on financial literacy which have lessons plans on reading (and maths).”

We shared with the group our existing indicators of financial capability by age which is taken from [the Young Money Financial Education Planning Framework](#), and invited participants’ views; there wasn’t much discussion around this, and nobody felt the need to contradict or question any of the items.

Financial capability indicators

Before five years of age, indicators of financial capability are limited to basic observations and simple choices. Understanding of money increases with age, with decision making capacity also becoming more advanced.

	Four years of age (pre school)	Four to five years of age (reception)	Five to six years of age (year one/two)
Awareness that different notes/coins exist	✓	✓	✓
Basic spending and saving knowledge	✓	✓	✓
Keeping money safe basics	✓	✓	✓
Simple spending and saving choices		✓	✓
Importance of looking after money		✓	✓
Understand why money is used		✓	✓
Recognise and name different notes/coins			✓
Basic understanding that money has a value			✓
Aware of different ways money can be used			✓
Understanding of needs vs. wants			✓
Secure understanding of saving principles			✓

It would be useful to know more about the developmental milestones that might relate to understanding economic concepts. For example, how understanding of time develops and how that might relate to concepts such as saving or delayed gratification.

3. The How: How can and should we be asking our research questions?

In this section, we asked about methodology: how we should be asking our questions, to whom and using what type of research instruments. We started with a discussion of target groups.

3.1. Target groups – parents, children and teachers

The participants agreed that it would be important to capture the views of children through their parents, because that is where much of the variation in children’s exposure to economic and financial ideas will come from; the older the child, the more we might be able to capture their views directly. We would certainly need to involve parents for any research that was carried out in a home setting, virtual or otherwise, and there is great potential for approaches that involve the parent and child coming to an answer together. This might involve using a questionnaire in a manner this is akin to a parent reading a storybook to their child; from time to time, they stop reading and start asking their child questions about their understanding before moving on.

AS: “I would not leave out direct assessments of four-year-olds but ask the parents as well. You may need the parent as a translator, but even at that age parents may not know everything their child knows, especially if the child spends time away from the parent, e.g., in nursery”

EK: “If we are committed to capturing the views of four-year-olds, I think we have to do it through the parents.”

SM: “Involving the child and the parent together in responding to a questionnaire

whereby the parent is given the opportunity to consult with their child... asking the parent to say a certain phrase to the child, and then they have a conversation, and then they decide on a response and that's the responses given.”

The participants also thought that it would be important not to disregard what we can learn from teachers, or from carrying out research in a school setting, not least because it can be easier and less resource intensive to get access to children in school. It may also be useful to explore schools that are using [the Young Money Financial Education Planning Framework](#), to understand how that links or contrasts with the curriculum. We would need to be mindful that any work with teachers would also need to help them in their aim of delivering the curriculum.

NE: “I agree... particularly regarding the four-year-olds where their parents would be their main source of knowledge...as children get older... schools have very tight assessment routines as well... so there is a bit of work that teachers can definitely contribute to.”

TJ: “It's relatively easy to get into a classroom and work with teachers and have conversations with children individually. You could do a lot of that and have some of this story and play-based conversations with children. Then also match that up with some of this work with children and parents together.”

There was also a sense that asking parents about financial activities could in itself be educational and prompt them into talking more about money with their children.

TJ: “This kind of exercise of collecting data [could also be] a way to communicate to some parent groups about some of the things they could do that are helpful... a lot of parents don't realize how important they are for their children's learning and education.”

3.2. How to measure in a research setting

The participants discussed the need to keep the language simple, and to keep the use of questions alone to the minimum, making it more fun and engaging by also using play-based research or gamification., Variety will also help to sustain a child’s engagement in the questions or activities. There is the potential to measure some of the aspects of financial capability in a very practical, experimental way, such as actually giving the child a pound as a reward for taking part and asking – and possibly following up – what they will do with it.

AS: “Have as little of a questionnaire as possible... physical concrete activities with questions only tagged on to the end.”

ND: “There's this belief that we shouldn't be burdening children with the topic of money, when in fact it can be something that's really fun for children to learn about. Using story telling and/or play take any burden out of the topic of money – at least for children.”

NE: “I'd think about minimal language and what kind of words you'd use... using pictorial representations as well, to support understanding... as well as differentiation and how it's delivered ... using different questionnaires.”

Observing children play can reveal much about how they think, and the assumptions and connections that they are making about money that they aren’t able to articulate. We know that children at this age understand more than they can necessarily convey.

AS: “Children with more/less/different exposure or knowledge may play differently and the differences in play will hint at how the exposure is different... I would emphasize not so much THAT kids make errors due to

lack of exposure/information, but HOW they fill these gaps in their imaginations, because the nature of their errors is a reflection of how they think.”

The difficulty with play-based research is that it implies being physically there with the child, which may be difficult due to coronavirus restrictions, and it is also resource-heavy and lends itself to qualitative assessments, rather than large-scale quantitative measurements. However, there are ways to make online quantitative research more tangible and playful, and less question heavy, such as pictorial, drawing or art-based, gamified and story-based approaches. Story-based approaches offer an opportunity for the child to put themselves in someone else’s shoes, or to distance themselves from an answer they feel might not be the ‘right’ answer – for example ‘what would the teddy do?’ instead of ‘what would you do?’ As such, story-based approaches resonated with all of the participants and are something we want to explore further.

TJ: “Another option is to use story-based assessment... short story strips where the child is asked, ‘So what should this character do next?’... It can help to make the question not about that child themselves, but about what they think somebody else should [or would] do...it can help separate what's the right thing from what I would do, because I'm not very good at self-control.”

ND “Drawing is another option of measurement, as is colouring in – asking children to draw or colour in the answer. Make the assessment fun so the child really wants to engage in it.”

ND: “It's important to delve into the different types of play⁶. You can learn a child's financial capabilities from solitary play, associative play when they're playing

⁶ Further information about the different types of play was added in the meeting chat. **Unoccupied play.** A child is just observing, not playing. **Solitary play.** A child plays alone without any interest in interacting with others. **Onlooker play.** The child is observing others nearby, but not playing together with them. **Parallel play.** A child plays or does the same activity as others around them at the

same time but may not interact with them. **Associative play.** A child plays side-by-side with others, engaging at times but not coordinating efforts. **Cooperative play.** The child plays with others while interacting with them and is interested in both them and the activity.

with someone else, or even cooperative play. Children go through a developmental stage of different types of play and during that, we can see whether they're sharing, negotiating, solving problems, self-advocating for themselves - all behaviours that feed back into financial capability."

AS: "In order to reduce the language demands on the child as much as possible, one can also do things like give them a cartoon sequence and then give them a choice of pictures with multiple possible endings or asking them to put the individual pictures in order."

The use of digital technology to engage children in play or game-based research was mentioned by SM referring to the UnLocke Project, Stop and Think Maths and science intervention⁷, a computer-based learning activity, as an example of making questions tangible for primary aged children online. Cognitive neuroscience research has shown that experts compared to novices are better able to suppress naïve theories and misconceptions they may hold since childhood and exercise reasoning to deliberate upon the correct response. This is referred to as cognitive control, or inhibitory control, which enables learning of counterintuitive concepts⁸. The Stop and Think intervention was designed to enable children aged 7-10 years to exercise inhibition control when thinking about counterintuitive mathematics and science concepts. It is created in gameshow format established as a collaborative peer learning virtual environment. One of the virtual peers acts as the host to pose questions and to prompt children to 'stop and think' about their answer strategy and to encourage the learner's engagement with three other virtual characters who act as contestants. A digital platform for measurement through play or game-based research appropriate for early years would be an engaging way to involve younger children in the research. See Appendix C for further information.

⁷ Wilkinson, H. R., Smid, C., Morris, S., Farran, E. K., Dumontheil, I., Mayer, S., & Thomas, M. S. (2019). Domain-specific inhibitory control training to improve children's learning of counterintuitive concepts in mathematics and science. *Journal of Cognitive Enhancement*, 1-19.

This section links back to earlier discussions about the need to keep questioning simple and focused on just one element at a time and suggests that, overall, there is a need for creative approaches, and for asking about the same issue in multiple different ways. Overall, the discussion around how to deliver in a research setting points to the need to consider mixed-mode assessments, so as to be inclusive, and to take different approaches depending on the age of the children; this idea resonated strongly and we feel will be key to the success of the project. In an ideal world where budgets and time weren't constrained, as well as conducting secondary research on the curriculum and assessments that already exist, we would collect data for each child involved in our measurement by talking to the teachers, the parents, the child, the child and the parents together, by observing the child in play and school settings and by conducting experiments with the child (such as giving money for the piggy bank). The reality will be a compromise between these options.

⁸ Mareschal, D. (2016). The neuroscience of conceptual learning in science and mathematics. *Current Opinion in Behavioral Sciences*, 10, 114-118.

4. Children with Special Educational Needs and Disabilities (SEND)

One of the big goals we have about how to ensure that our measurement includes children with SEND is to consider this from the start. Experience shows that if we create a framework without SEND in mind, it is not effective to try retrofit it afterwards to be inclusive. It may be that we need to create a general framework that is as inclusive as possible, and then identify the gaps issues and challenges in using the framework for measurement with children with SEND.

The group discussed how difficult it was to be prescriptive about what is needed to conduct this type of research, because the spectrum of SEND is so broad, and the needs are so diverse.

NE: “It depends on the nature of the SEND... it's a vast spectrum. You've got children with language needs, but it might be very much linked to expressive language and they might not be impacting so much on their receptive language. We have children with autism who may have very good understanding of number, but the comprehension may not be in [the same] place.”

The participants noted that in some ways this is less of an issue than might be expected. Any sample of children is likely to include those with special needs because there are so many that can't be diagnosed by the age of six. The wider goal of the research, therefore, should be to be fully inclusive regardless of needs and abilities. The main ways to achieve inclusivity are through careful attention to language and through offering multiple ways of approaching the question – pictures, stories, play activities, audio or text.

It will be important as part of this upfront thinking about SEND to recognise that children are affected both by the constraints of the SEND and by the impact on their life experiences and opportunities. This implies that we will need to ask the mainstream question set, plus extra questions of parents of children with SEND, to assess the impact of the SEND and get that essential contextual and

life experience information that we discussed earlier. We will also need to work with parents of children that we know have SEND or can identify prior to the assessment.

EK: “I think we need the same questions plus more... We could try and think of additional questions that might be more tailored to those children, particularly the younger children. So does having SEN mean that you're delayed in your exposure to economic opportunities... if a child's got ADHD, does the parent not take them to the shops because it's a stressful encounter... and not because that child couldn't understand the experience?”

Another point to consider is how to be inclusive of parents who themselves have learning or other disabilities.

Overall, the discussion points to the need to have a core research approach that will be carefully designed to be as inclusive as possible, as well as additional questions to capture elements of SEND and different SEND contexts.

5. Summary and next steps

5.1. Key takeaways

The What:

1. Children can understand economic concepts such as take, give, swap, share and lose, even from as early as four years of age.
2. Children may understand a lot of things about money at age four, but not necessarily be able to connect them all together.
3. It will be helpful if we separate asking about children's understanding of economic concepts from their understanding of money and from their numeracy.
4. We still need to measure numeracy and understanding of money, but we need to simplify our questioning, so we are only asking about one thing at a time.
5. Children's behaviour, attitudes, values beliefs and confidence around money will be influenced by their parents' behaviour, attitudes, values, beliefs and confidence.
6. Children's behaviour, attitudes and beliefs are also influenced by their personality and time perspective.
7. Children develop at different rates and understanding of a concept is not binary, so it is difficult to say exactly what children can and can't understand at different ages.
8. However, there are differences between what we can ask of a child of four versus one of six.
9. We can't understand a child's financial capability until we can understand their context and the family's social-economic and cultural background.
10. It will be important to measure the economic activities that children have experienced.

The How:

11. We need to talk to parents of four-year-old children and may or may not address questions to the children directly at this age. If we do include the children, the approach

needs to be much more concrete task or game based than direct questions.

12. By the age of six, we can ask children to answer more directly, albeit mediated by parents.
13. Most of children's economic activity will be in the home, but teachers can contribute to helping us develop questions in terms of what is in the curriculum, and any formal or informal assessments they make in the school.
14. When we are addressing children directly, we need to reduce the amount of questioning alone, and use tools such as pictures or story.
15. Story can help further as it can act as a projective device – 'What would this child do in this situation?' rather than 'what would you do?'
16. We need to ensure that any language that is used is simple and inclusive.
17. We want to include children with SEND, but recognise that is a wide spectrum. However, we also recognise that many special needs are undiagnosed in children aged four to six, so the research needs to include everybody, regardless.
18. The research will need to include children with SEND from the design phase. It won't be effective to design a study for the mainstream and then try to retrofit it to include children with SEND.
19. It would be most inclusive to conduct the research using multiple methods – online and in person.
20. We should also consider using different questions for different ages and asking the same questions in different ways – using picture, story, text, audio or spoken.

5.2. Next steps

1. Explore existing frameworks and other studies mentioned (see list below): The participants have suggested several studies some of which also include assessment of children's skills and understandings of several relevant concepts. MaPS would like to explore further whether there are other

skills assessments out there that we can draw lessons from for how to measure capability for this age group.

2. We didn't have time to discuss the following two items and MaPS will seek further input in these areas as the project progresses:
 - How do we ensure the validity and reliability of any frameworks/questionnaires developed?
 - How we can future proof the research design, so that we could take a longitudinal approach if needed
3. MaPS will use the learnings from this workshop discussion to start putting together a draft outline of a measurement framework. Where possible, we will continue to work with experts on several elements, including the areas to be included, any gaps that need to be addressed, how to formulate some of the questions aimed at children, parents/carers and/or teachers. We will also re-visit the questions which are currently used to measure financial capability outcomes for under 7s in our existing Children, Young People and Parents Outcomes Framework and evaluate these questions in the light of what has been discussed in this workshop. NE also suggested the possibility of working with DfE in sharing the findings.
4. MaPS will also continue to explore further the 'How' element. Where possible, this exploratory work may include working with experts to design short story-based questions and more concrete, game-oriented tasks to test how these approaches may work both in a small setting as well as in a UK wide research project.

5.3. Recommended reading

Children and economics

Berti, Anna & Bombi, Anna & (trasl, Gerard. (1988). The child's construction of economics.

Decision making

Smith, C. E., Echelbarger, M., Gelman, S. A., & Rick, S. I. (2018). Spendthrifts and tightwads in

childhood: Feelings about spending predict children's financial decision making. *Journal of behavioural decision making*, 31(3), 446-460.

Delayed gratification and self-control

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H. & Caspi, A. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the national Academy of Sciences*, 108(7), 2693-2698.

Richmond-Rakerd, L. S., Caspi, A., Ambler, A., d'Arbeloff, T., de Bruine, M., Elliott, M. & Moffitt, T. E. (2021). Childhood self-control forecasts the pace of midlife aging and preparedness for old age. *Proceedings of the National Academy of Sciences*, 118(3).

Development

Paul Webley's work on what children understand and believe at different ages

Webley, P. (2005). Children's understanding of economics. In M. Barrett & E Buchanan-Barrow (Eds). *Children's Understanding of Society*. Hove: Psychology Press.

Siegler, R. S., & Thompson, D. R. (1998). "Hey, would you like a nice cold cup of lemonade on this hot day": Children's understanding of economic causation. *Developmental psychology*, 34(1), 146.

Maths and numeracy

[Why do people get so anxious about math? Orly Rubinsten | TED-Ed](#)

Use of story

An example of parent and child reading specially created picture books together, designed to trigger parents and children talking, in the example, about gender stereotypes, but could be used in the context of finance.

Gelman, S. A., Taylor, M. G., Nguyen, S. P., Leaper, C., & Bigler, R. S. (2004). Mother-child conversations about gender: Understanding the acquisition of essentialist beliefs. *Monographs of the Society for Research in child Development*, i-142.

Time perspective and financial literacy:

https://www.penzugyiszemle.hu/pfg/upload/pdf/penzugyi_szemle_angol/volume_63_2018_1/A_ZsoterB_2018_1_M.pdf

<https://www.researchgate.net/publication/321399746> Time Perspective and Financial Health To Improve Financial Health Traditional Financial Literacy Skills Are Not Sufficient Understanding Your Time Perspective Is Critical

<https://www.researchgate.net/publication/228634854> Influence of Future Time Perspective Financial Knowledge and Financial Risk Tolerance on Retirement Saving Behaviors

https://link.springer.com/chapter/10.1057/978-1-137-60191-9_2

<https://www.semanticscholar.org/paper/Influence-of-future-time-perspective%2C-financial-and-Jacobs-Lawson-Hershey/d3e1409d17d7149780c90573e71ea15cac16abcc>

Children's sense of time:

<https://www.scholastic.com/teachers/articles/teaching-content/ages-stages-how-children-develop-sense-time/>

<https://thepsychologist.bps.org.uk/volume-25/edition-8/children-and-time>

Children's understanding on the fairness of sharing resources as a function of group membership and availability of resources

These links were supplied by Professor Denis Mareschal, the UnLocke Project Principal Investigator.

<https://onlinelibrary.wiley.com/doi/abs/10.1111/desc.12695>

<https://psycnet.apa.org/doiLanding?doi=10.1037%2Fa0034169>

https://www.sciencedirect.com/science/article/pii/S0022096516000291?casa_token=1dS9sc2HXN0AAAAA:tjwHry6XQJno7-7BkKsRjjrj7hClvJuVmPLvQRCr1B-UC4STB-TPcHq9snE8yU2Vf7IJGrZkQ

<https://psycnet.apa.org/doiLanding?doi=10.1037%2Fa0023869>

Appendix A: Time perspective and financial capability

Further notes on this topic supplied by Dr Nicola Davies after the event.

According to Boyd and Zimbardo (2012), all individuals have a preferred 'time perspective' – and this can be impacted by numerous factors such as culture, family, and level of education.

This theory has been supported by other researchers, with the key finding being that our preferred time perspective is learnt.

The three time perspectives we tend to fit into are:

- **Present-oriented** (present-hedonistic and present-fatalistic) – a positive or negative attitude towards the present
- **Past-oriented** (past positive and past negative) – a positive or negative attitude towards the past
- **Future-oriented**

So, how does this link to financial capabilities?

The **present-hedonistic** individual is looking for excitement and will take financial risks to live in the moment. These people will find it difficult to delay gratification. They may understand what wants and needs are but will be drawn to wants.

The **present-fatalistic** individual feels out of control of their life – and sometimes even their finances. They could go either way with delayed gratification – accepting their belief that they have no control and therefore 'giving in' or desperately trying to exert control and therefore delaying gratification in that effort.

Past-oriented (negative) individuals may lose confidence in their financial capabilities if they focus on past mistakes, whereas **past-oriented (positive)** may use mistakes to learn and build on their financial capabilities.

Future-oriented individuals set goals and work out how they can achieve them – they are much more likely to be savers and will be able to delay gratification.

Since time perspective is believed to be a learnt behaviour, it will be easier to measure in parents via questions. However, I do believe you will be able to pick up clues to child time perspective in a variety of ways also:

- The terminology/speech they use when playing
- The types of games they play
- Whether they plan or set goals
- Whether they can resist 'wants'
- Whether they talk about the past and in what context (i.e., do they dwell on the past or learn from it?)

Time perspective may also be impacted by social determinants of health. For example, low SES families who may be living day-to-day, meal-by-meal are more likely to be present-oriented.

Appendix B: Attachment theory and financial locus of control

Further notes on this topic supplied by Dr Nicola Davies after the event.

There are some additional psychological concepts that need to be considered within the MAPS strategy for measuring financial capability in 4–6-year-olds. These include:

- Attachment theory
- Financial locus of control

Attachment Theory

Attachment theory plays a huge role in our understanding of child development. Our style of attachment is formed at a very young age and can, in part, explain many of our behaviours and choices as both children and adults. It can even help explain our personality. Behaviours, choices and personality all influence our financial capability.

While attachment theory has traditionally been used to describe interpersonal relationship dynamics, it is increasingly being recognised that our attachment style also impacts other relationships – including our relationship with money.

The four core styles of attachment are:

- **Secure** – those with a secure attachment style are likely to have a positive view of themselves and others.

**If we apply this to financial capability, these individuals are likely to be secure in their financial capability and comfortable with financial independence. They trust in themselves.*

- **Dismissive-avoidant** – those with a dismissive-avoidant attachment style are likely to have a positive view of themselves and a negative view of others. They are likely to be independent and self-sufficient individuals.

**If we apply this to financial capability, this could be advantageous (taking control of one's finances and not being reliant on others.) However, it could also prevent someone seeking help or advice if they are struggling with their finances.*

- **Anxious-preoccupied** – those with an anxious-preoccupied attachment style are likely to have a negative view of themselves and a positive view of others. They can become dependent on others due to their anxiety. They can doubt their self-worth, blaming themselves if things go wrong and being impulsive in relationships.

**If we apply this to financial capability, this attachment style could lead to a lack of confidence with managing money, handing financial affairs over to someone else, and impulsiveness with money.*

- **Fearful-avoidant** – those with a fearful-avoidant attachment style will fluctuate in their view of themselves and others, often due to past losses and trauma. Inconsistent parenting can also contribute to this style of attachment, where children don't know what to expect (e.g., one time they cry after a fall, their parent comforts them; another time, their parent shouts to get up because perhaps they are in a rush).

**If we apply this to financial capability, this attachment style could lead to unpredictable behaviours. For example, a child who sometimes receives pocket money, but also sometimes has it taken away if a socially disadvantaged parent needs it, may spend the pocket money as soon as it comes in and before it can be taken back. This doesn't mean they lack financial capability; their behaviour is based on their current environment. On the other hand, in the same situation, a child may save their pocket money and not spend it in case their parent needs it.*

What does the literature say?

- People with an insecure attachment style tend to display money seeking behaviour.⁹
- People with an avoidant attachment style have been found to use money as an alternative path to gain identity and self-worth.¹⁰
- High romantic attachment anxiety is associated with less responsible financial behaviour and low financial satisfaction in young adults.¹¹
- High romantic attachment anxiety and attachment avoidance are associated with 'perceived' less responsible financial behaviour of partners – leading to lower relationship satisfaction.¹²
- In people with attachment anxiety, money can be a way to 'buy' love/admiration.¹³
- Individuals with attachment anxiety are less likely to negotiate (for salary, etc.).¹⁴
- Individuals with attachment avoidance have better negotiation propensity, possibly because they attach importance to money.¹⁵
- Individuals with low attachment anxiety and high attachment avoidance are better 'sellers.'¹⁶

The bottom line

Attachment in early childhood forms our core understanding of the world, which also translates into our understand of other aspects of life, including money.

Our adult attachment style is often a reflection of our childhood attachment style. If we know a child's attachment style it is likely that we can

predict certain financial behaviours during childhood and as adults (although no longitudinal research has been done on this; the research tends to be with adults).

When we think about measuring complex concepts, such as financial capability, in very young children (4-6 years), we need to work at the level of the child. For this age group, life is about their attachments (they are dependent on their parents).

It is by assessing and understanding these aspects of the child's world that we will be better equipped to understand how they think, feel and behave with more 'adult concepts' such as money.

Financial Locus of Control

Locus of control (LoC) is the degree to which people believe that they, as opposed to external forces (beyond their influence), have control over the outcome of events in their lives.

There are two types of LoC:

- **Internal** – when a person believes they have control over whether there is a positive or negative outcome to an event or action.
- **External** – when a person believes outcomes in their life are the result of luck (or bad luck), fate or unforeseen circumstances, rather than being within their control.

*If we apply this to financial capability, those with an internal LoC are likely to take responsibility for their finances and any financial outcomes, including learning from financial mistakes. In contrast, someone with an external LoC may lack financial responsibility and feel helpless in terms of their financial health. Research has also found that people with an external LoC are more impulsive and self-

⁹ <https://www.tandfonline.com/doi/abs/10.1080/10478400802631295>

¹⁰ <https://www.tandfonline.com/doi/abs/10.1080/10478400802631295>

¹¹ <https://link.springer.com/article/10.1007/s10834-020-09664-1>

¹² <https://link.springer.com/article/10.1007/s10834-020-09664-1>

¹³ <https://www.tandfonline.com/doi/abs/10.1080/10478400802631295>

¹⁴ <https://onlinelibrary.wiley.com/doi/abs/10.1111/ncmr.12055#:~:text=Though%20individuals%20with%20attachment%20anxiety,a%20secure%20or%20avoidant%20counterpart>

¹⁵

<https://onlinelibrary.wiley.com/doi/abs/10.1111/ncmr.12055#:~:text=Though%20individuals%20with%20attachment%20anxiety,a%20secure%20or%20avoidant%20counterpart>

¹⁶

<https://onlinelibrary.wiley.com/doi/abs/10.1111/ncmr.12055#:~:text=Though%20individuals%20with%20attachment%20anxiety,a%20secure%20or%20avoidant%20counterpart>

destructive in various areas of life and are more likely to take risks. Risk taking is associated with financial capability and financial decisions.

The link between LOC and financial capability has led to the term ‘financial locus of control.’

What does the literature say?

- LoC has been found to have an impact on savings and pensions,¹⁷ budgeting,¹⁸ and stock investment.¹⁹
- An internal financial LoC is associated with higher financial capability.²⁰
- An external financial LoC is associated with lower financial capability.²¹
- Understanding LoC can facilitate how we talk to or teach children about financial management. Having children own certain aspects of their personal financial situation from an early age can teach them that if they engage in certain behaviours (e.g., saving money) they will affect how much money they have in the future and what they can purchase. This ties in to delayed gratification.²²
- On the other hand, if children are consistently helped out financially and never have to take responsibility for money, it will feel out of their control – as will the consequences of their financial actions.²³

The bottom line

This is only a small reflection of the literature on LoC and financial capability. There is strong evidence supporting its role in financial capability and it needs to be factored in when understanding financial capability with any age group.

¹⁷ <https://ideas.repec.org/a/eee/jbfina/v73y2016icp113-130.html>

¹⁸ <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1745-6606.2005.00016.x>

¹⁹ https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2886778

²⁰ https://8b109582833d5c2e19d5-b8e01d380645fda9dfa9d12a21c5e59a.ssl.cf3.rackcdn.com/download/Beyond-financial-literacy_The-psychological-dimensions-of-financial-capability_Technical-report.pdf

²¹ https://8b109582833d5c2e19d5-b8e01d380645fda9dfa9d12a21c5e59a.ssl.cf3.rackcdn.com/download/Beyond-financial-literacy_The-psychological-dimensions-of-financial-capability_Technical-report.pdf

²² <https://www.datapoints.com/2018/10/31/locus-of-control-financial-success/>

²³ <https://www.datapoints.com/2018/10/31/locus-of-control-financial-success/>

Appendix C: The Unlocked project (Stop & Think Intervention)

Further notes on this topic supplied by Dr Sveta Mayer after the event.

Background and potential for MAPS assessment framework:

The UnLocke Stop & Think computer-based intervention (Wilkinson et al, 2019) is created in gameshow format established as a collaborative peer learning virtual environment. One of the virtual peers acts as the host to pose questions and the game prompts 7–10-year-old children to ‘stop and think’ about the question along with three other virtual characters who act as contestants. The three contestants model the ‘Stop and Think’ behaviour and provide examples of maths and science reasoning, whereby one

character responds with the correct answer, one responds with a naïve theory/misconception and one responds with a generally incorrect response. (Figure S3).

The game comprises of presenting a series of mathematics and science problem sets. We focused upon problem sets that would exercise inhibition control of maths and science naïve theories/misconceptions. The problem sets included questions on maths and science national curricula visually presented in such a manner that the question would elicit children’s naïve theories/misconceptions, but learners were required to exercise inhibition for 4 seconds before responding, i.e., to stop and think before they responded. Questions that would not induce naïve theories/misconceptions were also included. The response types were varied to ensure different cognitive and procedural aspects of reasoning. (Figure S6)



Figure S3. ‘Stop & Think’ interface and inhibitory control prompts

i. Game show host Andy reminding the user to ‘stop and think’ before responding to the task. ii. Pulsing ‘Stop and Think’ logo (bottom left of screen). iii. Contestants’ presenting their thoughts (reasoning) about the task. In this example, the character Candice has the correct reasoning, Ollie has the intuitive incorrect reasoning, and Kate is more generally incorrect. iv. The contestant with the correct reasoning is revealed.

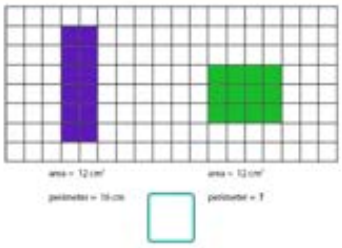


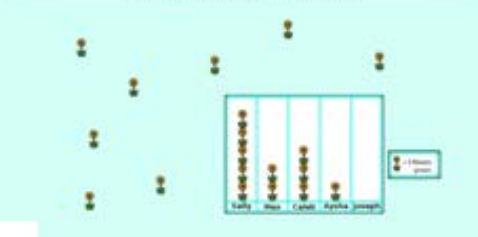

<p>Both shapes have an area of 12cm squared. What is the perimeter of the green shape?</p>  <p>i.</p>	<p>Max turns the radio on. How does sound travel so that Amy can hear the radio?</p>  <p>ii.</p>
<p>Which of these are a source of light?</p>  <p>iii.</p>	<p>Put these numbers in order from smallest to largest</p> <p>9 -10 4 -5 0</p> <p>Small Large</p> <p>iv.</p>
<p>Joseph planted 6 flowers. Add flowers to the pictogram to show how many flowers Joseph planted.</p>  <p>v.</p>	<p>Click on the ovary of this flower.</p>  <p>vi.</p>

Figure S6. Stop & Think subtask examples with different response types.

i. Enter, Year 5 Mathematics. Incorrect intuitive reasoning: If the magnitude of the areas of two shapes are identical, the magnitude of the perimeters of the same shapes are also identical. ii. Select, Year 5 Science. Incorrect intuitive reasoning: Sound travels in straight lines. iii. Sort, Year 3 Science. Incorrect intuitive reasoning: The moon is a source of light. iv. Order, Year 5 Mathematics. Incorrect intuitive reasoning: Negative numbers increase in size in the same way positive numbers do (i.e. $-5 < -10$). v. Construct, Year 3 Mathematics. Incorrect intuitive reasoning: In a pictogram, each item always represents one unit. vi. Select, Year 3 Science. No counterintuitive concept.

The intervention is delivered by teachers to whole class of pupils in their classroom using the interactive whiteboard. In addition, Stop and Think also has the capability to function as an assessment tool for measuring children's understanding of counterintuitive mathematics and science concepts – this assessment functionality requires individualised engagement and is currently under development.

Executive functions involve inhibition control (the focus for Stop and Think intervention), working memory, cognitive flexibility, organising and planning and, behavioural and emotion control. They develop rapidly in early years, first five years, and then steadily into adulthood. Executive functions are domain-general in that they can process any type of information. In relation to the UnLocke project, we considered inhibition control and processing of mathematics and science information.

However, interestingly domain-general executive functions can develop as domain-specific functions, that is executive function is embedded within domains, i.e., knowledge bases, such as mathematics and science, as we have in Stop and Think. The knowledge base represents factual, conceptual and procedural knowledge within a domain. This means for MAPS there is utility of measuring domain-specific executive function associated with numeracy, money, financial and economic capability (Center on the Developing Child (2012), Drever et al., (2015)). Here, we may find cognitive flexibility, planning and emotion control may be of relevance.

The challenge to establishing a MaPS assessment framework will be in mapping the knowledge base starting from early years, when there is either no or, naïve understanding, through to maturation of understanding into adulthood. This may be undertaken by drawing upon existing literature and curricula for mathematics, financial and economics to ensure age-appropriate engagement.

Wilkinson, H. R., Smid, C., Morris, S., Farran, E. K., Dumontheil, I., Mayer, S., ... & Thomas, M. S. (2019). Domain-specific inhibitory control training to improve children's learning of counterintuitive concepts in mathematics and science. *Journal of Cognitive Enhancement*, 1-19.

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Appendix D: Participants and their area of interest and expertise

(In alphabetical order)

Associate Professor Anne Schlottmann, UCL Psychology and Language Sciences

Anne Schlottmann studies cognition in children and adults, in particular the intuitive and perceptual bases of our understanding, how they develop from infancy, and how they interact with more reasoned conceptions later on. Her work focuses on causality and probability/utility. One of her major interests is causal understanding, with a focus on the perceptual pre-configurations that underlie many of our deepest beliefs about the world. She has studied observers between preschool age and adulthood, but in recent years a strong emphasis has been on habituation studies with infants.

Her second major interest is the development of judgment and decision. She studies children's reactions to probable losses rather than gains, framing effects in judgment and choice, their assessment of uncertain goals in achievement-motivated situations, and conditions that induce very early understanding of multiplicative compensation as in expectancy-value trade-offs.

Relevant publications include: Judgement and decision-making in young children (with F.Wilkening); What's fair? How children assign reward to members of teams with differing causal structures (with K.Koskuba et al.)

Dr Elizabeth Kilbey

Dr Elizabeth Kilbey is a Consultant Clinical Psychologist, specialising in working with children and young people, both in the NHS and privately. In the NHS, she works predominantly with children with complex neuro-developmental difficulties including Autism, ADHD and Learning Disabilities. Dr Kilbey runs her own independent Clinical Practice. She offers a wide range of neurodevelopmental assessments for Autism, ADHD and Dyslexia for adults and children. In addition, she offers a comprehensive school consultation service including classroom observations and academic and school-based

assessments. Dr Kilbey also provides a limited therapy practice.

Dr Kilbey is a highly regarded Expert Witness who has completed in excess of 150 court appointed assessments for the Family Courts. Most recently, she has been commended by a senior Judge for the clarity and depth of her evidence provided in Court.

Dr Kilbey was the resident on screen expert on Channel 4's The Secret Life of 4-, 5- & 6-Year-olds. Dr Kilbey was involved in every series of the show and provided insight into the behaviour and psychological world of the children. She is also the published author of 'Unplugged Parenting'.

Dr Nicola Davies

Dr Nicola Davies started her career in measurement of adults' health-related outcomes, looking at the psychometric properties and operational characteristics of questionnaires. She served on the UK Department of Health Metrics Group at the time; and has, since, been involved in research on health literacy, which is closely related to financial literacy.

She is a trained counsellor who previous work involves working with children as well as adults. She has published a number of articles in early years and parenting magazines, as well as teaching magazines; and has been involved in research on the role of gamification in engaging people in providing their data.

Most recently, she has been involved in re-writing some of our core content on the MaPS website on children and young people and money management from a behavioural perspective. She is currently devising a psychology module for students wishing to learn about the various stages of child development.

Nicholas English

Nicholas English has been an Educational Psychologist for 19 years with the last 6 years being employed as Principal Educational Psychologist in the London Borough of Sutton. Previous to working in Sutton, Nicholas held roles in Kingston and Richmond with a specialism

in supporting children with autistic spectrum needs and developing the provision in the local area for supporting learners' emotional literacy skills. Prior to qualifying as an Educational Psychologist, Nicholas worked in an urban London Primary School teaching Key Stage 2 pupils.

Running alongside this, Nicholas is also seconded for a day a week by the Institute of Education (UCL) as a tutor on their Doctorate Educational Psychology Programme. As well as supporting trainees in developing their practice, the role also involves teaching on subjects such as phonics, assessing needs and theories of intelligence.

Professor Parama Chaudhury, The UCL Centre for Teaching and Learning Economics

Parama Chaudhury is an economist at the University College London. Her research interests include labour economics, specifically inequality and technological change. She has a keen research interest in education and in thinking about how economics concepts are taught and learned. Her work also looks at the role of technology in higher education, and she is Founding Director of the Centre for Teaching and Learning Economics. She currently serves on the Teaching and Learning Committee of the CORE Project and on the Royal Economic Society's Education Committee.

She has recently led the CTaLE Team in designing and delivering several bespoke economics training courses for government departments, including the Cabinet Office and the Foreign, Commonwealth and Development Office; and has received an award from UCL for her work in economics education consultancy. Among her recent publications are her chapter on "Best practice and innovations in economics education" in A Handbook of Teaching and Learning in Higher Education (ed. Stephanie Marshall, Routledge, 2019); and her work on UCL's BME Attainment Gap Project in Compass.

Dr Sveta Mayer, UCL Institute of Education

Sveta Mayer is a lecturer and researcher at UCL Institute of Education, Department of Learning and Leadership and member of the Bloomsbury

Colleges Educational Neuroscience Centre Research Group. Her research and teaching are interdisciplinary within the field of educational neuroscience. She uses mixed methods and participatory approaches and focus on social neuroscience informed design and evaluation of education interventions for supporting socioemotional cognition, mental health, and academic learning in autistic and non-autistic children.

Sveta has experience of supporting education practitioners' evidence-based practice through inquiry-based learning, from early years to KS5. Her current research projects are: UnLocke project funded by Education Endowment Fund/Welcome Trust (<http://www.unlocke.org/>), Youth MHFA (London) Evaluation funded by the Young Londoners Fund, Mayor of London (<https://mhfaengland.org/mhfa-centre/news/thriveldn-youth-mhfa-schools/>) and Design and Effectiveness of a Social-Emotional Regulation Education Tool for Children with Autism Spectrum Disorder.

Professor Tim Jay, Loughborough University

Tim Jay researches the psychology of mathematics education. His main focus is on using design research methods to translate insights from psychology and neuroscience to create new findings and impact in formal and informal education contexts. He also has an interest and experience in leading large-scale evaluations of education interventions.

Tim's recent research includes studies that have explored children's out-of-school economic activity, and studies that have explored issues around parental involvement in children's mathematics learning. He is interested in ways that children's classroom experience and out-of-school learning do and do not align, and the implications that this can have for pedagogy and learning design."

In one of his most recent articles with Ulises Xolocotzin, 'Children's perspectives on their economic activity – Diversity, motivations and parental awareness', Tim looks at investigates how children from an affluent city in the UK exercise agency to construct their economic worlds. The study showed children's economic

activity involves individual and social motivations, occurs in formal and informal contexts, and is often self-regulated. Parents acknowledge children's monetary activities and neglect non-monetary activities. The results suggest that children's agency unfolds in diverse economic activities shaped by contextual factors and interactions with peers and parents.

The Money and Pensions Service (MaPS) Team

The MaPS team who attended the workshop included Ipek Ozgul Noel (Insight and Evaluation), Helen Pitman (Insight and Evaluation) and Evelyn Omoike (Children and Young People Policy).

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