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Key Topics in Education

A Chapter Sampler

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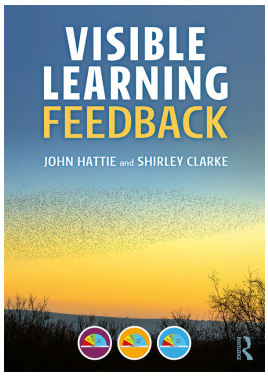
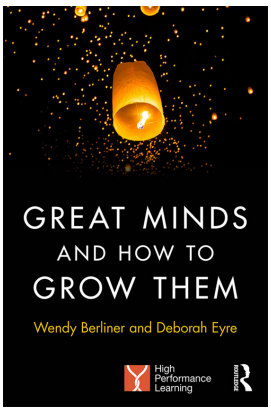
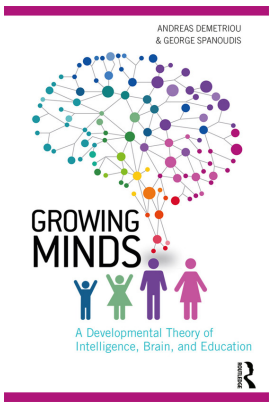
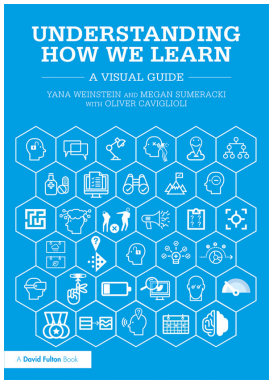
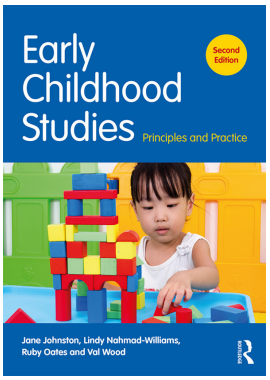
Contents

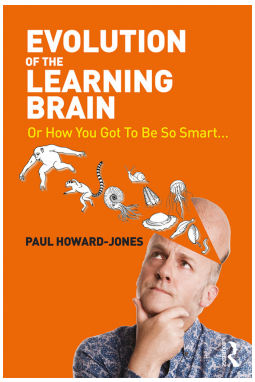












CHAPTER 1

What is feedback?

This chapter summarizes the key points about the nature and development of feedback thinking by educators and academics, laying the foundation for the related issues to be explored throughout the rest of this book. The subsequent chapters are closely tied to the life of a teacher and a student in the day to day structure of lessons, as outlined in the introduction: culture, learning strategies, in lesson feedback and post-lesson feedback. Practical examples, wherever possible, will bring the findings to life.

We have asked thousands of teachers to answer the following question in a short sentence: What do you mean by feedback? These are typical of the ten main explanations:

Comments – give comments on the way you are doing something
Clarification – answering student questions in class
Criticism – when you are given constructive criticism
Confirmation – when you are told you are doing it right
Content development – asking about the comment
Constructive reflection – giving someone positive and constructive reflections on their work
Correction – showing what you did right or wrong, which helps you
Cons and pros – someone telling the pros and cons about your work
Commentary – they comment on my work
Criterion – relative to a standard

We have also asked as many students the same question, and by far the top explanation of their list is: feedback helps me know where to go next. Oftentimes when feedback is more about the above ten Cs, the students will claim that they did not receive any feedback. Some direction, some 'where to next?' feedback based on the ten Cs, however, is probably more powerful, as it helps defend the

reasons for moving forward. A major focus in this book is ensuring there is 'where to next?' feedback provided.

Some history . . . marking and grading

Not very long ago the word 'feedback' was rarely used. In the US, the term 'grading' covered what was then, and still often now, is assumed to be the most conventional way of giving some kind of response to students about their work or learning. In the UK and other countries, the term 'marking' was used to describe grades, comments or both. The feedback in this form was mainly summative and from teacher to student only. That isn't to say that formative, oral, immediate, student to teacher and student to student feedback wasn't taking place, but it had not been highlighted for its significance.

Marking and grading had come under fire in various studies. Ruth Butler's (1988) famous study, for instance, in which students were given either: a) grades, b) comment only or c) grades and comments found that those in the comment only groups had greater gains in progress (measured by test results) than the other two groups. Wherever positive comments accompanied grades, interviews with students revealed that they ignored those comments in favor of the grade and what it was telling them about their performance. They added that the positive comments were the teacher's way of cheering them up. Grades encourage students to develop ego-related mindsets rather than task-related mindsets. Grades often tell the student 'the work is over'. We must not confuse grading with feedback.

As comment only feedback became more common, the next step was to make sure it was specific enough to make a difference. The Office for Standards in Education (Ofsted) (the schools' inspection service) wrote to schools in England in 1996:

> Marking is usually contentious but often fails to offer guidance on how work can be improved. In a significant minority of cases, marking reinforces underachievement and under expectation by being too generous or unfocused.

The essential message is that the most valuable feedback focuses on helping the student improve. If the comments do not provide 'where to next' or 'how to improve this work' information then grades might be the only worthwhile indicator; but if grades are given with no other information, this might not lead to defensible interpretation as to current or future improvements.

Teachers were generally giving grades, comments, or both, to students *after* lessons, and these were seen as the most important and expected form of feedback. It

was also discovered that most comments, unless they required a student response, were often ignored by students if the feedback comments were given out with no time allocated for students to read the comments, no chance to use them to improve, or where they were illegible or hard to understand (e.g. Clarke, 2001).

Feedback: timing

Nuthall and Alton-Lee (1997) found that all students, regardless of their level of achievement, typically need to be exposed to any new learning at least three to five times before it has a high probability of being learned.

> Our data does not support the notion that lower achievers need more instruction. The critical requirement is that all students get access to comparable opportunities.
>
> *(Nuthall & Alton-Lee, 1997)*

During the multiple opportunities for learning and engagement, teachers need to provide feedback to refine the student's understanding of the content. Teachers need to plan for students' misconceptions to be identified, explored and challenged, to make transparent the links with their prior experiences and to provide multiple opportunities and scaffolding to make those links with new information: the essence of effective feedback. Nuthall is quite emphatic that students do not need merely repeated trials at tasks – there must be punctuating feedback. Doing the same thing (making the same errors) repeatedly leads to overlearning the wrong things. Neither should students have simply more experience of the same teaching, but instead a variety of experiences and feedback over three to five interactions.

Feedback: what matters

Hattie and Timperley (2007) defined feedback as relating to actions or information provided by an agent (e.g. teacher, peer, book, parent, internet, experience) that provides information regarding aspects of one's performance or understanding.

Feedback is information about the task that fills a gap between what is understood and what is aimed to be understood. It can lead to increased effort, motivation or engagement to reduce the discrepancy between the current status and the goal; it can lead to alternative strategies to understand the material; it can confirm for the student that they are correct or incorrect, or how far they have reached the goal; it can indicate that more information is available or needed; it can point to directions that the students could pursue; and finally it can lead to restructuring understandings. Royce Sadler (1989) set the scene in his seminal paper by

establishing the concept that feedback is information that 'closes the gap' between where a student is and where the student needs to be:

> The learner has to a) possess a concept of the standard (or goal or reference level) being aimed for, b) compare the actual (or current) level of performance with the standard, and c) engage in appropriate action which leads to some closure of the gap.

Once 'feedback' entered the teaching vocabulary, the power of verbal, in-lesson feedback between all parties and the place and quantity of post-lesson feedback became, and remains, a key focus. The research findings made the scope of feedback something that could not be ignored.

Rather than general, meaningless comments as feedback to the student (e.g. 'Try harder'), Terry Crooks revealed the most effective feedback content (2001):

> The greatest motivational benefits will come from focusing feedback on:
>
> - the qualities of the child's work, and not on comparison with other children,
> - specific ways in which the child's work could be improved,
> - improvements that the child has made compared to his or her earlier work.

All this needs to be undertaken in a climate of high trust and reduced anxiety. The issue of the attention paid to children's self-efficacy and self-esteem and the use of external rewards and other forms of extrinsic motivation was linked with types of feedback:

> Feedback is most effective when goals are specific and challenging but when task complexity is low. Giving praise for completing a task appears to be ineffective. Feedback is more effective when there are perceived low rather than high levels of threat to self-esteem.
>
> *(Kluger & DeNisi, 1996)*

Getting underneath student understanding, finding out what they really think, is the starting point of all feedback, from whichever direction, because only then can the feedback be appropriately constructed to provide advice:

> When I completed the first synthesis of 134 meta analyses of all possible influences on achievement (Hattie, 1992), it soon became clear that feedback was among the most positive influences on achievement . . . The mistake I was making was seeing feedback as something teachers provided to students. I discovered that feedback is most powerful when it is from the student to the teacher. What they know, what they understand, where they make errors, when they have misconceptions, when they are not engaged – then teaching and learning

> can be synchronized and powerful. Feedback to teachers makes learning visible. (Feedback effect size 0.73)
>
> *(Hattie, 2012)*

Feedback can have many functions: reinforcing success, correcting errors, helping to unravel misconceptions, suggesting specific improvements, giving improvement advice for the future, praising, punishing or rewarding, all with different levels of effectiveness. Who gives the feedback, whether it is task or ego related, and *how and whether it is received and acted upon* are all factors in its effectiveness. This last point is particularly pertinent: more attention needs to be given to whether and how students receive and act upon feedback, as there seems little point in maximizing the amount and nature of feedback given if it is not received or understood. This is why, throughout this book, we emphasize the interpretations that are made by the receiver about the feedback, and how it helps them answer the question 'Where to next?' or 'How could this be improved?'

Feedback thrives on errors and misconceptions. It might seem pointless to receive feedback about 'where to next' if our work is perfect, although in the case of almost all learning, there can always be some improvement and, in any case, knowing where to next in terms of extending one's learning is always valuable. The power of feedback focused on error and misconceptions is further explored in Chapter 3.

Both positive and negative feedback can have beneficial effects on learning. The untangling of these effects depends on the level at which the feedback is aimed and processed and the interactions between the validity of the feedback and the self-efficacy levels of students. In particular, negative feedback is more powerful at the self-level, causing personal evaluation. Both types can be effective when feedback is about the task, but there are differential effects relating to commitment, mastery or performance orientation and self-efficacy.

That students are taught to receive, interpret and use the feedback provided is probably much more important than focusing on how much feedback is provided by the teacher, as feedback given but not heard is of little use. Students, like adults, quickly learn to be selective listeners – feedback often means more investment in improvement, repeating the work and putting in more effort. Feedback can impact our beliefs about our work, our judgments about quality and can have other costs. The art is turning these costs into benefits in terms of deeper, worthwhile and valuable learning.

Finally, feedback needs to be combined with effective teaching and learning strategies to have the greatest impact. Sometimes, re-teaching is more powerful than just providing feedback. Feedback alone is not the magic bullet, as we describe in the following chapters:

- The culture required to best enable effective feedback.
- The types of teaching and learning strategies and techniques which form a structure within which to create effective feedback opportunities.

- Examples and analysis of the different types of in-lesson feedback.
- Examples and analysis of post-lesson feedback including to and from outside school partners.

Having summarized what we know about feedback, it is important that we acknowledge the fundamental problem – while feedback is powerful, it is also among the most variable of influences. The same feedback in one situation might be worthwhile, but in another situation of little value. Indeed, Kluger and DeNisi (1996) noted that one third of feedback was negative in its impact! Understanding this variability is critical, which is why simple claims about feedback are of low value, a problem explored throughout this book.

The following graphic from 'Coaching Teachers in the Power of Feedback' (Figure 1.1), a resource used in a research project in Australia (Brooks, 2017), summarizes the feedback cycle:

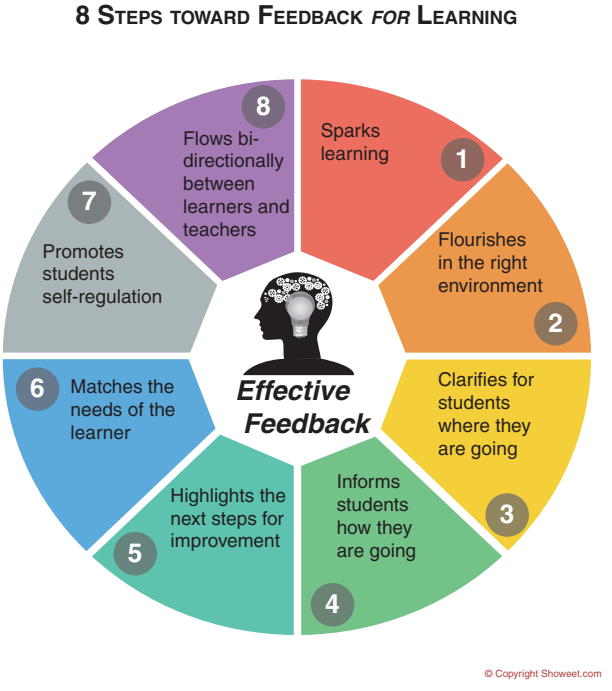


Figure 1.1 Toward feedback for learning

Key points

- Feedback is powerful but variable in its impact on learning.
- Grades or comments with no focus on improvement might interfere with learning.
- Students prefer immediate feedback, but delayed feedback can be beneficial.
- Prior knowledge is the starting point for feedback.
- Feedback is about closing the gap between current and desired learning.
- Goals should be specific and challenging, but task complexity low.
- High self-efficacy and trust are needed for feedback to be effective.
- Student to teacher feedback is more important than teacher to student.
- Effective feedback occurs when it is received and acted upon.

Chapter 4

Think right

Help your child think their way to high performance by flexing those learning muscles

We have learned that when we want to prepare our children to be successful at school we can look at the lessons of the successful and how they create their success; we can learn from them and we can help our children adopt these successful approaches.

Combining the latest research with studies done over the last 40 years, what we now know about how successful people are created suggests that if we are a little bit more targeted in how we parent our children we can make a real difference to how successful they are at school and beyond. That's growing great minds.

What we need to do as parents is systematically try to focus on creating opportunities that enhance what we call the advanced cognitive performance characteristics (ACPs) and the values, attitudes and attributes (VAAs) that are needed for success at school and in life. The ACPs centre on how successful learners **think** and the VAAs centre on how successful learners **behave**.

In this chapter we are going to concentrate on the advanced cognitive performance characteristics – the way that people with advanced learning skills think – and in the next chapter on how successful learners behave – their values, attitudes and attributes. Some of the characteristics and behaviours may sound a bit similar but the subtle differences between them are important and shouldn't be overlooked. It may seem quite a long list, but don't be overwhelmed. Any list of written instructions you see for the first time, for doing anything worthwhile, building a piece of furniture, driving a car, filling in your tax return, can look daunting but it's manageable when you get down to it and use the right thinking approach.

Both sets of characteristics and behaviours can be learned by pretty much anyone and parents can develop conversation and discussion at home which can underpin this. One discussion can cover off many characteristics or attitudes – you don't have to do different things for every one. This is a natural and normal way of being with your child on a daily basis.

Remember your child can start the discussions; it doesn't have to be you all the time. Just be on the lookout for conversation opportunities that will help them develop good thinking and learning. If you start answering their 'Why?' questions from an early age, they will keep asking. It's the children whose parents don't answer their questions in the early years who stop asking and reduce their learning opportunities as a result.

What makes the gifted appear gifted is that children or adults are either introduced to these ways of thinking and behaving earlier than others or they show more initial aptitude for thinking this way. As Shore (2000) said: 'gifted children differ from others to the extent to which they draw on a repertoire of intellectual skills that are *nonetheless available to others*' (our italics).

So let's have a look at that repertoire by considering the advanced cognitive performance characteristics.

Advanced cognitive performance characteristics – the details

There are five broad groups of advanced cognitive performance characteristics – meta-thinking, linking, analysing, creating and realising. Let's go through them one by one describing what they are, looking at why they are important and following with practical conversation starters which can help to develop them.

Meta-thinking

This is a set of four characteristics that relate to thinking about thinking. They consist of:

- meta-cognition;
- self-regulation;
- strategy planning;
- intellectual confidence.

In summary, this set of characteristics allows children to be aware that they have a repertoire of skills – an intellectual toolbox – to dip into and the self-awareness to know which tool is best to use for the job. This gives them confidence as a learner because no matter how difficult the job, they can think of a way or ways to tackle it. To use an analogy we mentioned earlier, they won't stop in the middle of trying to put up a new shelf because it's hard and they say they are rubbish at it – they will look into their toolbox and find a tool or tools to help them complete the job. Crucially, they have learned what tool fits different jobs best.

Let's look at the four characteristics of **meta-thinking**:

1 **Meta-cognition** – this means being aware of possible thinking approaches that might be useful in any given context and then knowingly using the one of your choice – for example, knowing how to do bigger sums based on how you've tackled smaller sums before or that you can build a bigger structure that won't collapse if you broaden the base. It is at the heart of using and applying information and is a critical skill in advanced cognitive performance. **It is using** an idea or skill (or a range of them), almost certainly learned doing something else, to tackle doing something new. It means you are never at a loss in working out how to learn something new.

Conversation starters to build meta-cognition: 'How could you do this? Have you done anything similar before? What did you do then? What approach could you use?'

2 **Self-regulation** – we talked earlier of this in the context of behaviour but this involves being able to monitor your own progress, evaluate what you are doing and correct yourself where necessary to keep on track. The child may be, for example, making biscuits or doing an essay on the rise of Nazism – the characteristic is the same – you have to follow the recipe or the homework question. You are setting your own goals, planning how to achieve them and also working out strategies of your own to reach your goals as well as using recommended strategies. The ability is essential if you are to become an advanced learner. **You are operating independently to plan, monitor and assess your own learning.** Children are far more likely to persist in learning something challenging if they are in control of their own learning. They are more engaged and more motivated to succeed. They are more likely to seek out help and support if they need it and we know they perform better in academic tests. **This characteristic is key to maximising the effectiveness of all the ACPs.**

Conversation starters to build self-regulation: 'What do you need to be able to do this? How can you check you're on track? How can you tell whether you are doing it right?'

3 **Strategy planning** – this is the ability to approach new learning experiences by actively attempting to connect them with something you know how to do already which means that you know the right way to **think** about how to do the work. Many children stumble and feel close to panic when they don't know how to begin something they've never done before. They are likely to dive right in and try

to muddle their way sequentially through it rather than assessing the thing as a whole and deciding what the best way to tackle it is and in what order. **Children who recognise that this is similar to a task** they did in a different topic and that they can use the successful strategy used then are planning strategically.

Conversations starters to build strategy planning: 'How would you plan to do this? How would you divide it up into sections so that everything gets finished? Does it remind you of anything similar you have done before – if it does, how did you tackle it then? Could you organise this a similar way?'

If they are still stuck you could encourage them to think of a different problem which might teach the same concept. For example, you could ask your child to construct a family tree of a stranger, maybe a well-known figure from history. Research will show up non-sequential and often extraneous information and they will have to plan strategically to get it into logical shape. Adapt the idea for the age and interests of the child.

4 **Intellectual confidence** – this is the ability to explain your personal views clearly, based on evidence you can articulate, and if necessary defend these views to people who disagree. **Social confidence and intellectual confidence are different.** Intellectual confidence is the ability to come to a conclusion on evidence yourself and then feel confident enough about it to defend your view. This can begin with very young children and develop as they mature. Getting them to come up with an argument supporting something and then opposing the same thing is great practice because it also helps children think more clearly about what they believe and why, but it also means they consider the arguments of others.

Conversation starters to build intellectual confidence: 'What do you think? Why do you think that?' This could be about something contentious in the news – the problems of overpopulation, for example, or environmental or scientific. Or it could be about something where there are divergent views – whether there is life outside our planet for example. And if you think very young children aren't able to do this, social media has plenty of examples of small children raging on about something – the difference between boys' and girls' clothes, for example, where one little girl thinks it's ridiculous that her clothes choices are principally pink – which their parents have videoed and posted. They can develop strong, well-thought-through views, if you encourage them to.

Linking

This is a set of six characteristics about linking what you learn together. The six characteristics are:

- generalisation;
- connection finding;
- big picture thinking;
- abstraction;
- imagination;
- seeing alternative perspectives.

In summary, these are a set of characteristics in which children link things they have learned. It is the ability to see learning as part of a larger scheme as opposed to a series of single events – it is the basis for individuals to construct meaning and understanding. It helps children and young people move forward securely and rapidly in their learning. It often also reduces the amount of time necessary for revision because they are secure in their knowledge. It's possible to teach or to train this.

Let's look at the six characteristics in detail.

1 **Generalisation** – this is the ability to see how what is happening in a particular instance could be applied to other situations. Children who can do this can see if a rule learned already can be applied to a piece of new learning. **Doing this makes learning quicker and more manageable** because if children can spot the universal applicability of something learned they can apply it to something new.

Conversation starters to build generalisation: 'Remember when . . . What is similar? What is different? Do you think that could work this time? Why?'

2 **Connection finding** – this is the ability to use connections from past experiences to seek possible generalisations. In some ways connection finding is a prelude to the ACP of generalisation. Looking for and making connections is the start of making sense of new knowledge and information. Children can be held back in their learning if they are always on the lookout for an overarching framing work within which to slot their newly acquired piece of information – like a piece in a jigsaw puzzle. **Encouraging them to draw connections between past and present learning** helps the child or teenager towards building a bigger picture that they don't yet know – they don't have the picture on the box of the jigsaw puzzle to work from.

Conversation starters to build connection finding: 'What does that remind you of? What did you do about it?' Or a play a game based on six degrees of separation, the notion that anyone in the world is a maximum of six steps away from another by way of mutual connections. You could

talk about how a fish is connected to a tree, a table to a boat or any other pairing of diverse and random things you care to come up with. It gets them thinking.

3 **Big picture thinking** – this is the ability to work with big ideas and holistic concepts. A key characteristic of students labelled as gifted is **their ability to see the significance of what they are learning and how it connects to the wider world.** It is motivational and encourages children and teenagers to want to learn even more, to take more interest in what they learn and to become more independent learners. Also, for some, showing how learning fits into a bigger world picture than school and exams is crucial if they are going to engage and succeed. It is a critical part of operating at an advanced level.

Conversations starters to build big picture thinking: 'What would happen if . . . it never got dark/the rivers ran dry/ everyone ignored the law?' Or any other big picture idea that you or your child come up with. 'Why is the sky blue, why does the wind blow, where do snowflakes come from? Are we alone in the universe?' These kinds of questions are limited only by the imagination of your child or your own, but are great for big picture thinking (and encouraging imagination).

4 **Abstraction** – this is the ability to move from a concrete to an abstract thought very quickly. For example, from one apple added to another apple making two apples, to the idea of one plus one equals two. You no longer need objects to prove the rule – you can work with an abstract concept, a number, an idea that doesn't need a physical presence. Reading a map but then understanding what turn to make at what junction to get home is moving from a physical presence – the map – to an idea learned in your head – the route home from school. It will differ in how it manifests itself in varying interest areas – a visually motivated child can easily imagine what a room will look like in a different colour, while a linguistic one may spot patterns in poetry, for example. Concrete learning is the preliminary to abstract learning. Abstract learning is essential to high performance.

Conversation starters to build abstraction: 'Tell me every stage you go through to . . .' It could be any physical practice, brushing teeth, getting dressed, painting a picture, scoring a goal – you know your child. Getting them to do this is encouraging them to think in the abstract, thinking something through in their head and not missing out important bits (like opening the toothpaste tube).

5 **Imagination** – this is the ability to **take prior knowledge and apply it to solving problems while thinking beyond the obvious.** Imaginative play is essential in helping curious children make sense of their world. Imagination is found in all children but like all the other thinking characteristics, it can be enhanced and developed. Howard Gardner believes each child, by the age of 7, has developed a creative capital upon which they draw throughout their adult life (Crain 2011). This well of creativity can be topped up throughout life but the richer the initial capital the more easily creativity flows. Creativity builds learning capability and is vital for high performance.

Conversations starters to build imagination: 'How would you weigh a giraffe/rhinoceros/bridge/house/star?' Be as imaginative as you would like to be in the kind of questions you ask – this can be a lot of fun!

6 **Seeing alternative perspectives** – this is the ability to take on the views of others and deal with complexity and ambiguity. Advanced cognitive performance includes the ability to deal with complex and sometimes conflicting ideas. There isn't always a 'right' answer and a child focused solely on 'getting it right' can be held back in developing their thinking and learning. It's an appreciation that situations can be complex and ambiguous and an ability to see that **different answers can be correct in different circumstances or in the outcomes we want to see.**

Conversation starters to build seeing alternative perspectives: 'Was Goldilocks a good girl? Should we reintroduce wolves to the countryside? Should we stop using pesticides? Should we spend money exploring space when people are starving on earth?' The topics can relate to the age of the child but the idea is to encourage a discussion in which the answers can be very different depending on your perspective but still 'right' for the perspective.

Analysing

This is a set of three characteristics about thinking logically and carefully. The three characteristics are:

- critical or logical thinking;
- precision;
- complex and multistep problem-solving;

In summary, advanced performers tend to be careful and logical in their approach to work even when being creative. Some of the most creative

outcomes in any domain, music or art for example, are constrained by responding to a set of rules and conventions – even if these have been constructed by the musician or artist themselves. They know how to think for themselves – some young people founder at university because they've never actually learned how to do that.

Let's look at the three characteristics in detail:

1 **Critical or logical thinking** – this is the ability to deduct, hypothesise, reason and seek supporting evidence and is probably the characteristic most generally associated with academic success. It is what Sherlock Holmes does! It is the intellectually disciplined process of looking at the information you have gathered over time and using it to decide on a solution or response. At its best, it is based on universal intellectual values that transcend subject matter division. **Developing this characteristic helps you perform well in most school subjects, university and future life.**

Conversation starters to build critical or logical thinking: 'Why do you think. . . we wear seat belts, bread goes mouldy if you leave it in the bread bin but not in the freezer, babies cry, leaves fall when autumn comes?' Think of the things that interest your child, at whatever age he or she is, and find something that will get your child deducing, coming up with answers and finding evidence to support those answers.

2 **Precision** – this is the ability to work effectively within the rules of a domain – an area of activity or knowledge. We all know what music played with the wrong notes sounds like – not that good. Being careless holds learning back; **being precise is a significant factor in reaching high levels of performance.** It is a discipline that comes more naturally to some but it can be encouraged and developed.

Conversation starters to build precision: 'Are you sure that's right? Have you checked this to make sure it's your best work?' If you know a child is doing something wrong because they don't yet know how to do it right, then correct them, with sensitivity, so they can learn from the mistake. You don't have to be a professional footballer to know that it's better to kick a ball with the side of your foot so if you see a small child using the front part of their foot to kick their football, show them how to do it right and the consequence that they can have more accurate control if they do.

3 **Complex and multistep problem-solving** – this is the ability to break down a task, decide on a suitable approach and then act. The more advanced learning becomes, the more complex it tends to become. To begin with, a child may be learning in small steps and can find it

easy to link each new step to the last one. As learning becomes more complex and multiple skills are needed, this can present problems in moving on in learning as a successful and independent learner needs to. **Learning how to create a plan for tackling a complex problem helps to make it manageable and realisable** and this is a characteristic that can be developed.

Conversation starters to build problem-solving: 'What do you need for school tomorrow? What do we need at the supermarket? What do we need to take on holiday?' The idea is to make the child think about the steps in a task – going on holiday, for example, involves lots of decisions relating to length of stay, the climate, the luggage allowance for an airline and so on. You can then remind them to do it for other problems until it is second nature for them to do so.

Creating

This is a set of five characteristics focused on creative thinking and learning. The five characteristics are:

- intellectual playfulness;
- flexible thinking;
- fluent thinking;
- originality;
- evolutionary and revolutionary thinking;

In summary, these characteristics help children cope independently when parents and other adults are not there to help solve problems. They offer the possibilities for solving problems we cannot even yet anticipate – particularly helpful in such a fast-changing world – and they may lead to powerful consequences in our lives and can produce great satisfaction and joy.

Let's look at the five characteristics in detail:

1 **Intellectual playfulness** – this is the ability to recognise rules and bend them to create valid but new forms. Inventors do this all the time, as do more avant-garde composers and artists. You could argue that Capability Brown – one of the greatest of all landscape gardeners – was intellectually playful, moving away from formal gardens and developing naturalistic settings for the parkland of his rich clients. Encouraging playfulness in learning is helpful because it is creative, motivating and not linked to convention. It can be appealing to children and teens with a sense of humour or to those who find more traditional forms of learning to be routine and unrewarding. Intellectual playfulness builds learning stamina and **helps to put an individual more in control of their own learning and be more confident** as a result.

Almost all areas of learning and activity have the potential for playfulness and the results can be memorable, satisfying and sometimes very amusing. Think of little children gleefully singing: 'While shepherds washed their socks by night' at Christmas. They're playing with words – just one example of intellectual playfulness.

Conversation starters to build intellectual playfulness: 'What if you did it differently? How could you do it differently?' Or get them to play around with things they already know and change them. They could make up their version of 'Monopoly' for example.

2 **Flexible thinking** – this is the ability to abandon one idea for a superior one or generate multiple solutions – and specific areas of the brain light up when we do it. This requires **the ability to think about two different concepts and to think about multiple concepts simultaneously**, not always a natural process especially when learning something new. The ability to think flexibly is a higher order cognitive skill and a key part of the toolkit for those who achieve high levels of cognitive performance. Intellectual confidence is needed in order to take the risk of thinking flexibly and not settle for the first answer. This can be taught and developed.

Conversation starters to build flexible thinking: 'How do you know that? What evidence do you have? What might someone else think? How could you argue the opposite?' Or, when an idea hasn't worked out, discuss with your child or teenager why it hasn't worked and encourage them to come up with a new idea.

3 **Fluent thinking** – this is the ability to generate lots of ideas, to understand that your best idea might not be your first and to keep on thinking until you're sure you've reached your best idea. Adults at work who use brainstorming when they get together with colleagues to tackle a problem or come up with ideas in a short period of time, bouncing off each others' ideas for inspiration are indulging in fluent thinking. Interestingly the latest thinking in this area is that someone brainstorming on their own comes up with more, and often better, ideas. Further, group brainstorming has its drawbacks – unusual ideas may not be valued by a wider group and innovation can be stifled in this way. Fluency is about generating ideas, not evaluating them. An idea that sounds unpromising can contain the germ of something very good.

Conversation starters to build fluent thinking: 'How can you. . .? What happens when. . .? Can you think of any other ways to do it? What could you do?' Encourage your child or teen to come up with as many solutions to the same question as they can.

4 **Originality** – this is the ability to conceive something new. It is at the crux of innovation and unless children and young people are actively encouraged to be original, and not just come up with the 'right answer', they might keep their ideas to themselves for fear of being wrong. **Something original doesn't have to be a life-changing discovery, it could be a simple solution or new approach to an ordinary problem.** Very little is completely original but everyone could make incrementally original discoveries which moves thinking on. Encouraging the confidence to break with tradition is a valuable attribute to nurture and is something the advanced learner does well. Many good pianists can play good quality classical piano pieces. But no one pays good money to go to a top concert venue to hear someone play at Grade 8 piano, good as that is. They go to hear the originality of the interpretation which is unique to the most advanced performer.

Conversation starters to build originality: 'Is there another way? What might be better? What would make it new?'

5 **Evolutionary and revolutionary thinking** – this is the ability to create new ideas by building on existing ideas **or** diverting from them. This helps in enabling children and teens to move away from existing ideas towards developing their own. **The advanced performer is unafraid of developing novel ideas that are different to existing ones.** This courage needs to be developed and valued. Mary Berry is an evolutionary cook who has created delicious new recipes by building on the accepted norms of cooking. Heston Blumenthal has also created delicious new recipes but his cooking is more revolutionary – using science heavily in his cookery, pairing foods with similar molecular signatures – like chocolate and caviar, for example.

Conversation starters to build evolutionary and revolutionary thinking: 'I wonder what would happen if. . .? What would it look/sound/feel like if you created. . .?'

Realising

This is a final set of just two characteristics that make use of all the other ACPs in a form that best ensures high performance. The two characteristics are:

- automaticity;
- speed and accuracy.

In summary, these characteristics relate to efficient learning. There is much to learn as a child or a young person and they can move on much more

quickly in their learning if they **learn to do some things so well that** *they* **can do them without thinking** – automatically – because that saves them mental time and space. Accuracy is critical to moving forward in the work they do as they learn because, again, it **speeds up the process of learning** and makes it possible for them to reach high levels of performance while they are still at school.

Let's look at the two characteristics in detail:

1. **Automaticity** – this is the ability to use some skills with such ease that they no longer require active thinking. If you are an experienced driver, you are practising automaticity every time you get behind the wheel. You no longer have to think about changing gears or checking the mirrors or any of the other things involved in getting a car to move safely – that's automaticity. For a child it might be learning their multiplication tables. To practise skills and learn facts to the point at which their execution or application no longer requires conscious thought is of great value in reaching advanced learning performance. Some children and young people have better memories than others but the vast majority can learn useful skills and information which can be of immense value. **Automaticity frees up cognitive resources. Multitasking – so common in our fast moving world – requires a degree of automaticity.** Children and young people used to video games, social media and juggling two (or more) screens at a time are likely to be more experienced at elements of automaticity than the older generations. The trick is to move the skill into more formal learning.
2. **Speed and accuracy** – this is the ability to work with accuracy at speed. If we learn from our mistakes rather than constantly repeating them we make faster progress. This seems obvious but some children and teens are much better at it than others and tend to become the advanced performers. Accuracy is more of a factor than speed in making fast progress. Some children naturally work faster than others and that is generally a personality trait rather than a cognitive one. **What marks out the high performer is that when they make a mistake they learn from it and adjust what they do in future accordingly.** Over time they become increasingly accurate. Accuracy is what should be encouraged in children and teens.

The way ahead – developing successful thinking

Now you can see how successful performers think, and why these ways of thinking are important in developing high performance learning; you may already be thinking yourself of ways you could encourage your child or teenager in habits of mind that will develop them into high performers at school too.

No one should know them better than you do, so you should know the kinds of things they are interested in. Use the ACPs to develop ways of

thinking in areas that already appeal and they should ultimately be able to use those learning approaches on everything – including areas of learning that currently don't motivate them.

Even the highest academic performer isn't interested in everything at school but tends to do well across the board anyway. They do so by using these thinking characteristics to do well in areas of learning that don't attract as well as the subjects they like most. It's a mental toolkit they carry wherever they go and it means they are never stranded while they are trying to learn new things.

These are generic ways of thinking that can apply to all learning, whether it's maths, music, metal work or anything else. And you can use the characteristics to develop yourself – everyone is capable of learning new things well into old age, remember. You don't have to be a child or a teenager.

The final point to make is that this can be tremendously fun and interesting as well as turning your child into a champion thinker and learner who does well at school. Here are two stories from our own lives to help explain.

Deborah was walking home with her son, Richard, from primary school one day when he noticed a muddy puddle and asked her why the water in the puddle was brown and the water that came out of the taps at home was clear. She explained by doing something very practical back home. She got him to collect a bit of soil from the garden and put it in a jug of water from the tap. They then used a coffee filter paper to pour the muddy water through – producing clear water. A perfect way to have a discussion about why water can be different colours – think of the sea compared with your bath, the deep ocean compared with the shallows of a Seychelles beach – and to discuss the notion of filtration and clean water, and how it gets to your house . . . and a whole lot of other things on the way.

Finally, Wendy picked her son, Michael, up from primary school one rainy day just as the sun came out and produced a beautiful rainbow. They both loved it and Michael asked whether they could try to find the end of the rainbow and the crock of gold supposedly buried there. For the next few minutes as the rainbow shone on they drove through the lanes near the school trying to reach the end of the rainbow. They never did of course, but they had wonderful conversations about why rainbows happened and what could be in the crock of gold!

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6

AWARENESS AND KNOWLEDGE ABOUT THE MIND

What do children know about the mind?

The mind is the bedrock of the psychological world. We might go as far as to say that the psychological worlds we live in exist because of the human mind. Our actions and feelings towards each other depend on how we register and represent the world. Our thoughts and ideas about each other guide our actions towards each other. Our personal experience, behaviour, and interpersonal relationships depend on the mental states we create as persons. In a sense our life is a dialogue between minds. Thus, according to some scholars, awareness of the mind is so important that it "is part of our social instinct": this is what channels children to learn about invisible, intangible, abstract states such as thoughts, beliefs, and desires (Leslie, Friedman, & German, 2004).

The study of awareness about the human mind may involve everything discussed in this book. Broadly speaking, it may involve awareness about: (i) *the content of the mind*, such as desires, beliefs, and concepts one holds or knows (or thinks) that others hold, and its impact on action; (ii) *the processes generating knowledge and understanding*, such as thinking, reasoning, imagination, learning, and memory; and (iii) *processes of consciousness, reflection, and self-control* that humans direct to their own mind in order to know it and change it, if needed. It is notable that research on the development of children's knowledge about the mind has been highly fragmented and even runs under different names. The study of knowledge about the content of mind and its role in human action is known as the study of *the theory of mind* (Perner, 1991; Wellman, 2014). The study of knowledge about mental processes is known as the study of *metacognition* (Efklides, 2008; Flavell, 1979). The study of consciousness comes under various names, including the study of self-awareness and self-representation in various domains, such as cognition, emotions, and personality. Below we summarize these fields of

research in order to highlight how awareness of the mind develops. Researchers ask four interrelated questions:

1. Do children understand the mind as something different from reality? That is, do they understand that the thoughts or ideas that they may have about an object or person cannot be identified with this object or person?
2. Do they understand the representational nature of the mind? That is, do they understand that thoughts, ideas and beliefs stand for objects, events, or mental states that express a particular aspect or perspective of persons?
3. Do they understand the causal role of mental activity and its products? That is, do they realize that what people do and how they do it depends on their thoughts, ideas, guesses, fantasies, beliefs, desires, or wishes?
4. Do they understand how mental activity is organized and functions? That is, do they have any understanding of the mind as a complex and diversified system comprising different functions, such as attention, memory, and reasoning, which are responsible for different mental jobs?

In short, the four sets of questions refer to the understanding of the ontological status, the representational nature, the causal role or agency, and the nature and functioning of the mind, respectively. We will summarize the findings about the four aspects of mind below.

Knowing about the mind or a theory of mind?

The study of the child's theory of mind has been one of the most active fields of research in developmental psychology in the last 30 years. A Google Scholar search under the term "theory of mind" gives an impressive 4,470,000 results (May 22, 2017), far higher than cognitive development (3,420,000), learning theory (3,250,000), psychoanalytic theory (695,000), psychometric theory (622,000) and Piaget's theory (101,000). Obviously theory of mind has dominated psychology for many years.

Understanding the ontological status of the mind

There is evidence showing that children at 3–4 years understand that thinking about an object is different from the object itself. For example, 4-year-old children understand that a rabbit and a monster they were asked to imagine are not real. However, when told that the researcher would leave the room, many children were frightened to imagine a monster. Even many 6-year-olds said they were afraid there might be a monster in the box (Harris et al., 1991). These findings confirm our experience that children continue to be frightened by their thoughts well into the school years. It is well known that some mentally ill patients, such as schizophrenics, cannot distinguish clearly the boundaries between the real and imaginal (Lysaker, Dimaggio, & Brüne, 2014). This evidence suggests that the imaginary

may be distinguished from the real at quite an early age. However, this distinction continues to develop for many years and under certain conditions it may break down at any age.

Understanding the representational and causal role of the mind

The experimental paradigm used to study children's understanding of the mind as a causal agent is rather simple. In the famous Sally task, the researcher places a candy in Box A in front of both the child and an assistant, the protagonist in the experiment. The protagonist leaves the room and the researcher moves the candy from Box A to Box B in his absence. The protagonist returns and the child is asked to indicate where he will look for the candy: in Box A (corresponding to the protagonist's representation of the candy's location) or Box B (corresponding to the child's representation of the present place of the candy). Tasks designed according to this paradigm have come to be known as the *false belief tasks*: the false belief ascribed to the protagonist that the candy is in Box A. Children who indicate location A are obviously able to understand that the representation of a given situation (a belief about it) depends on available information and that a person's behaviour originates from his representation (looking for the object following the belief). Children who indicate position B are obviously unwilling to differentiate their own representation from that of others, in effect projecting their representation on others. Many studies showed that 3-year-old children cannot solve this task but that 4-year-olds can. Based on this evidence, theorists concluded that 3-year-olds do not have a theory of mind but 4-year-olds do. Moreover, it was assumed that 3-year-olds may have a representational deficit which does not allow them to differentiate their own mind from another's mind or recognize that different persons may have different beliefs which can lead to different behaviour (Wellman, 1990).

What do standard false beliefs tasks, such as the Sally task, measure? It might be the case that these tasks only capture a very simple dichotomous understanding of the mind: that children at this age understand that others may not know what they themselves know and they may therefore act differently based on what their own knowledge is. However advanced this understanding may be, it deviates from a complete metarepresentational understanding of the mind. This would require a propositional attitude to representations which would direct a search for intensional relations between them; this would allow inference about actions of different persons associated to each person's perspective (Rakoczy et al., 2015). Examples are described below. In these tasks there is an overlap of properties, such that the same object possesses two properties (e.g., a pencil that rattles, boy Peter who is also a firefighter). In the set-up of the experiment the child tested is aware that one property is associated with Box 1 and the other property is associated with Box 2. However, the protagonist whose action the child must anticipate is not aware of the overlap: he saw the first property placed in Box 1 and the second in Box 2 but did not see the transformation of the object from the first to the second property. The logic of these experiments is shown below and demonstrated in Figure 6.1.

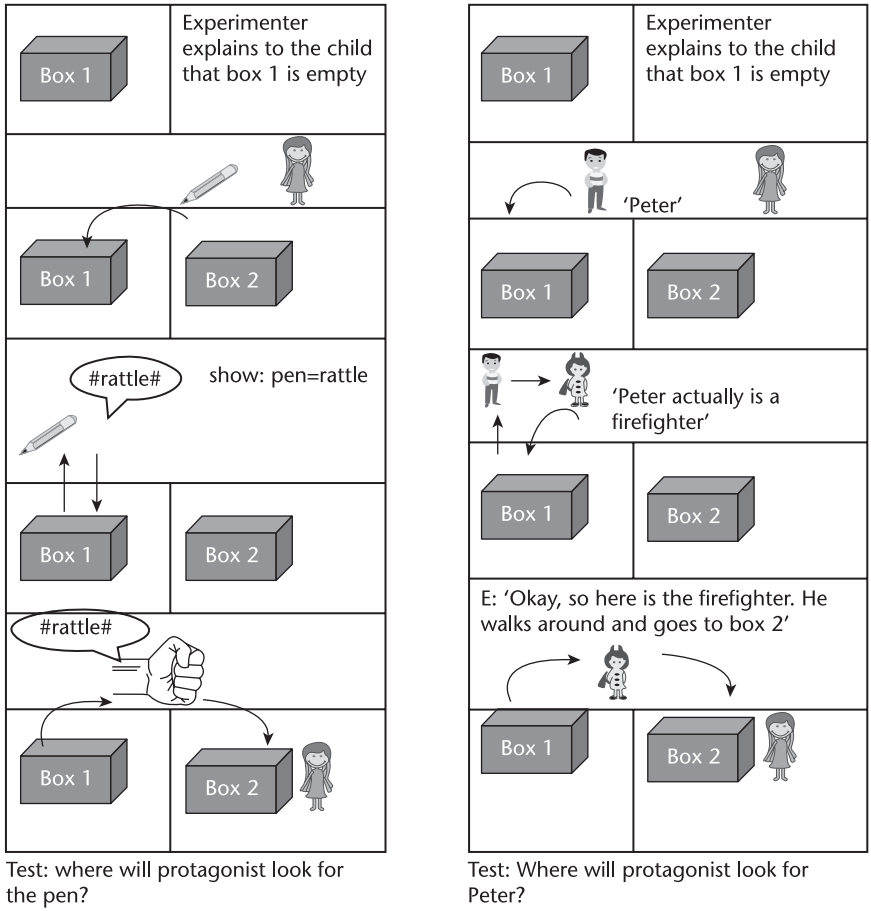


FIGURE 6.1 Examples of theory-of-mind tasks involving appearance transformations preserving the identity of stimuli involved (Reprinted with permission from Rakoczy et al., 2015)

(1) There is an A in Box 1.
(2) There is a B in Box 2.
(3) The B in Box 2 is also an A.
(4) The protagonist knows that (1) and (2), but does not know that (3).

Test question: the protagonist is looking for an A. Where will he go to find an A? (Correct answer: Box 1).

These tasks are solved at the age of 4–5 together with standard false belief tasks, such as the Sally task. This finding implies that children at this age are capable of a unified understanding of propositional attitudes and their implications. That is, they can align specific representations with specific perspectives, thereby accurately interlinking action with each actor's perspective: I know that object A

(appearance-representation #1) and object B (appearance-representation #2) are the same (transformation-representation #3) but look different because they appear under a different appearance in boxes 1 and 2 (e.g., neutral dress and firefighter uniform, i.e., identity-representation #4). The child possesses all four representations and the metarepresentational awareness that actions derive from the representations one possesses; thus knowing that the protagonist possesses representations #1, #2, and #4 but not #3 that interlinks the rest, the child anticipates the protagonist's actions accordingly. The revolutionary accomplishment of this developmental phase allows the building of reasoning abilities and the executive possibilities discussed in the previous chapter.

Halford, Cowan, and Andrews (2007) maintained that this representational revolution is possible at this age because the relational complexity of false belief tasks is equivalent to ternary relations that are mastered at this age. Specifically, Halford and colleagues argued that false belief tasks require to (1) represent the object location (2) the actual movement of the object that (i) was seen by the child (ii) but not by the protagonist, and (3) the representations themselves, i.e., what is represented in one's own (2i) and the protagonist's mind (2ii). These researchers showed that performance on false belief tasks was related to performance on various other tasks requiring ternary relations, such as grasping the cardinality of number, transitivity, class inclusion, appearance-reality distinction, and executive control. Moreover, they showed that 80% of age-related changes in theory-of-mind tasks were related to the ability to process increasingly complex relations (Andrews, Halford, Bunch, Bowden, & Jones, 2003).

However, this accomplishment is only a step along a long road of developing awareness from birth to adolescence. On the one hand, there is evidence that even 15-month-old infants have some grasp of the perception-belief-behaviour connection. Onishi and Baillargeon (2005) presented the following sequence of events to 15-month-old infants. First an actor saw an object placed in a green box; then the actor's view was blocked and the object was moved to a yellow box; then the actor appears again and looks for the object in the yellow or the green box; infants showed surprise when the actor looked for the object in the yellow box, against his belief. This was interpreted to imply that young infants have an intuitive grasp of the essentials of theory of mind. There is also evidence that children adapt their behaviour (e.g., to name and point to the place where an object was placed before) depending on their understanding of the knowledge state of the person they are addressed to (e.g., if object placement occurred in front of this person or not) (O'Neill, 1996). Obviously these findings suggest that there is awareness about mental states and their role in behaviour before the advent of language.

This is reflected in the fact that 2- and 3-year-olds who fail the false belief tasks are quite capable of deception. From a cognitive point of view, deception implies that the deceiver recognizes there may be alternative representations of the same reality and that it is possible to create in the other's mind a representation which is different from the representation that she herself holds. In their experiments, Chandler, Fritz, and Hala (1989) showed that, by the age of 2, children understand

that withholding or destroying evidence can deceive someone and that, by the age of 3, they understand the role of lying. In fact there is evidence indicating that 3-year-olds can pass false beliefs tasks if they are embedded in a context of deception.

Deception is not the only context in which children demonstrate an understanding of the other's mind. Wellman (1990) carried out extensive research to show that children younger than 4 are much more sensitive to desires than beliefs as mental states which can produce a response. In his experiments he showed that 3-year-olds can solve problems like the following: "Sam wants to find his puppy. It might be hiding in the garage or under the porch. Where will Sam look for his puppy (garage or porch)?" Three-year-olds were able to correctly predict Sam's behaviour even when the representations seemingly changed, as indicated in the following story: "Before Sam can look for his puppy, Sam's mother comes out of the house. Sam's mom says she saw his puppy in the garage. Where will Sam look for the puppy?" According to Wellman, these findings indicate that 3-year-olds have a theory of mind, and he argued further that, as the child's theory of mind develops, the importance of desire as a causal agent of behaviour lessens in favour of belief. This seems to imply that the theory of mind is originally geared to mental states associated with the dynamic aspects of people's behaviour (i.e., states which are related to emotion and motivation) and it then extends to include those states relevant to the cognitive aspects (i.e., representations).

On the other hand, higher-order theory-of-mind tasks are grasped much later than false belief tasks. In higher-order theory-of-mind tasks, representations about knowledge and beliefs are embedded into one another, as often happens in real life. For instance: {John thinks that [Mary knows that (Michael wanted)] to have an ice-cream}. Higher-order theory-of-mind tasks may vary in complexity from the first order, such as the Sally task, to the second order, the third, as in the example above, or an even higher order. Second-order theory-of-mind tasks are solved in the early primary school years but third or fourth tasks are solved later, at the end of primary school (Rakoczy et al., 2015; Liddle & Nettle, 2006). Obviously grasping multiple-order theory-of-mind tasks indicates the kind of compositionality, recursivity, and hierarchical integration that is ascribed to language of thought by cognitive scientists.

Carpendale and Chandler (1996) also showed that understanding the interpretative nature of mind is attained at the age of 7–8. For instance, preschoolers do not understand, but primary school children do, that different characters may interpret the phrase "wait for a ring" (i.e., a phone call or a diamond ring) differently, depending on the information they have. Obviously understanding of interpretations requires a more complex understanding of the nature of the mind. This involves understanding the role of initial premises in the chain of an argument (e.g., wait for a professional message versus wait for a wedding proposal) and also the inferential processes that link premises into a sequence leading to a conclusion. It is noted that Wellman showed, in a series of longitudinal and meta-analytical studies, that the sequences above reflect genuine changes in the representational and conceptual abilities of children (Wellman, Cross, & Watson, 2001; Wellman, Fang, & Peterson,

2011). It is notable that the various states of the theory of mind acquired at different age phases are longitudinally related. Brooks and Meltzoff (2015) showed that infants who were better at gaze-following at 10.5 months possessed more mental-state words at 2.5 years; in turn, children who knew more mental-state words at 2.5 years were better in dealing with theory-of-mind tasks at 4.5 years. These results suggest that gaze-following in early infancy reflects a broader capability to tune one's own behaviour with the mentally bound behaviour of others as reflected in their gaze. This capability provides the framework for learning mentally rich aspects of language, such as mental verbs. In their turn, mental verbs provide the representational framework needed to build the intensional attitude underlying false belief and other theory-of-mind tasks. Next we will summarize research related to the child's understanding of the nature and functioning of different mental functions.

Understanding the organization and functioning of the mind

Research on the development of the child's understanding of the organization and functioning of the mind sought to highlight how, if at all, different cognitive functions and processes are understood at different ages. Flavell and his colleagues presented a series of ingenious studies about the development of children's knowledge about thinking, which they "broadly and minimally defined as mentally attending to something" (Flavell, Green, & Flavell, 1995, p. v). According to these studies, the development of even this simple understanding is a process that evolves over many years. Specifically, preschoolers seem to "have at least a minimal grasp of the bare-bones essentials of thinking: namely that it is some sort of internal, mental activity that people engage in that refers to real or imaginary objects or events" (p. 78). Preschoolers also realize that thinking is different from perceiving and that it is different from other cognitive processes such as knowing. In one of their experiments, Flavell and colleagues showed that 3-year-olds understand that a person who is blindfolded and has her ears closed cannot see nor hear an object but she can think about this object. Another experiment showed that 3- and 4-year-olds equally understand that a person is thinking when she is in the process of choosing one out of a number of available objects or when she tries to understand how a curious thing happened, such as how a large pear fitted into a bottle with a narrow neck. Another study showed that young preschoolers understand that a person can have knowledge of things she is not currently thinking about.

In line with these findings, Paulus, Proust, and Sodian (2013) showed that children have some awareness of their own mental states from about the age of 3. These scholars trained 3.5-year-old children to associate individual animals with specific objects. They showed them short videos presenting an animal doing something (e.g., an elephant who likes watching TV). Sometime later they showed the probe animal (e.g., the elephant) and they tested if children remembered the object associated with it (a TV). They also asked the children to indicate how confident they were of their judgment. Confidence ratings for correctly remembered

items were higher than ratings for incorrectly noted items, suggesting an awareness of representations stored earlier in memory.

However, there are important aspects of thinking that preschoolers do not understand. Specifically, there is compelling evidence that they do not understand what William James called the "stream of consciousness", i.e., they do not realize that thinking is a process which goes on continuously in people's minds, even when they sit quietly and do nothing. In one of Flavell et al.'s studies, preschoolers ignored very clear cues about the ever-presence of thought activity. For instance, the large majority of preschoolers refused to agree with the statement "something is always going on in people's minds, so there must be something going on".

Preschoolers also do not realize that cognitive activities such as looking, listening, reading, and talking necessarily entail thinking. Even when they attribute mental activity to a person, preschoolers seem unable to specify the content of the person's thinking despite very clear and indicative signs. Flavell and colleagues conducted an experiment confirming this: with a preschool child as the subject, one researcher (A) asked another (B) a thought-provoking question about an object in the room. B said to A, "That's a hard question. Give me a minute", and she turned to one side, giving non-verbal cues that she was trying to find an answer to the question. Preschoolers were not able to indicate that researcher B was thinking about the object named in the question and many continued to have difficulty with this seemingly simple problem, even when researcher B stared at and touched the object while he was thinking about it. In fact preschoolers seem to have difficulty specifying the content of their own thoughts. For example, when asked to name the room in their house where they keep their toothbrush they did not mention either a toothbrush or a bathroom when asked what they had been thinking about.

Because they cannot identify the content of their thought, they are unaware of *cognitive cueing*, the associative nature of the mind. That is, they do not realize that one idea or thought triggers another, which triggers another, and so on. For example, when told a story about a child who thinks of beautiful flowers while on the beach, they cannot explain why that child thinks of the beach when he later sees some beautiful flowers. Finally, preschoolers do not seem to understand that thought is partly controllable and partly uncontrollable, i.e., that you can start thinking about something if you decide to but you cannot always stop thinking about something just because you want to. All of these difficulties diminish considerably or are removed by the age of 7–8.

The studies reviewed above suggest that preschoolers differentiate thinking from other cognitive (i.e., perception) and non-cognitive (e.g., movement) activities but that they do not yet understand how thinking is activated or how it works. Fabricius and his colleague (Fabricius & Schwanenflugel, 1994) reported a series of studies concerned with a complementary question in which they examined whether children understand the similarities and differences between different cognitive functions such as memory, reasoning, and comprehension. Their studies involved adults and 8- and 10-year-old children. These participants were given simple descriptions of list memory (e.g., getting all the things at the store that your mother asked you),

prospective memory (e.g., saying happy birthday on the right day to your friend who told you her birthday a long time ago), comprehension (e.g., learning a new board game from the instructions on the box), attention (e.g., listening to what your friend is saying to you in a noisy classroom), and inference (e.g., figuring out what your friend wants when he says, "Boy, that cookie looks good!"). The participants were asked to contrast each sentence with all other sentences and indicate the degree of similarity among the processes referred to in each pair of sentences. It was found that, from the age of 8, children can distinguish between memory and inference. For adults and 10-year-olds, but not 8-year-olds, the involvement of memory in tasks is taken as an indication of similarity between the processes supposedly involved. Unlike adults, however, neither 8- nor 10-year olds could distinguish between comprehension and attention or between different kinds of memory. Thus it seems that by late childhood children begin to distinguish between different cognitive processes. This differentiation is very global, however, and limited to processes which have clear experiential differences. In addition, children aged 6–8 do not prepare sufficiently to cope with a forthcoming task because they are not explicitly aware that different tasks require relevant preparation. This is attained at about the age of 10 (Chevalier & Blaye 2016). Children in this phase understand that more difficult items require more study time if they are to be successfully stored and recalled (Tsalas et al., 2017).

Know yourself

The knowledge about the mind discussed above focuses on specific processes and states. However, ever since the time of the Greek philosophers, knowing oneself has been of major concern to our understanding of human thought and action. Kant and other philosophers noted that intelligence only exists as a part of a knowing self. In psychology, James (1890) established the self as a central construct that generates knowledge about one's own attributes and characteristics and gives meaning to experience. We will show later that the construct of the self is pivotal in our understanding of the relations between intellectual development and personality.

In the classical theory of James (1890), the self is a central construct that organizes and gives meaning to experience. In this theory, the self involves two dimensions: the "I-self" and the "Me-self". The I-self comprises self-observation and self-recording processes. The Me-self includes the knowledge generated by the I-self about mental, social, personality, and bodily characteristics. James's distinction between a knowing (the I-self) and a known self (the Me-self) is present in modern theories of the self (Brown, 1998; Hattie, 1992; Markus & Wurf, 1987). For example, in Markus's model (Markus & Wurf, 1987) the working self-concept is differentiated from the collection of self-representations possessed by the individual. The working self-concept involves all presently accessible self-representations and it is directly involved in the formation and control of behaviour at both the intra- and the interpersonal level. Therefore, in this model, the working self-concept assumes the functions of the Jamesian I-self, which generates self-descriptions, which belong to the Jamesian Me-self. The Me-self is a hierarchical system involving

various sub-systems, such as academic self-concept, social self-concept, etc. In turn, each of these sub-systems involves more local components, such as, for instance, self-concept in mathematics, science, language, etc. Obviously the I-self includes cognizance as specified in our theory. The Me-self includes knowledge and beliefs systems about the self, as specified in various theories.

The I-self and the Me-self are molar constructs leaning on the processes generating and modifying a person's theory of mind and the content that it produces for oneself. The I-self may be seen as the mechanism that generates the person's knowledge of the organization and functioning of the mind. To the extent this is applied on other persons, then, the I-self becomes the source of the person's theory of mind. The Me-self is the crystallized aspect of the functioning of the I-self so defined. What might the molecular mechanism be?

Theory of mind or self-awareness and mindfulness?

The research summarized above on theory of mind and the understanding of the organization and functioning of the mind suggests a rather radical conclusion: human understanding of the mind emerges from a broad, very comprehensive self-centred and mind-centred monitoring system that attends to, registers, and stores information about mental functioning and states, but also about other aspects of behaviour and functioning. This system is associated with self-control and self-regulation of one's own actions and interactions with other persons. Therefore the term "theory of mind" is very limited as a description of the changes occurring in the child's understanding of the mind. Even the false belief tasks, so widely used, do not really tap children's knowledge of the mind but only one aspect of children's understanding of the mind of others (Bloom & German, 2000; Stone & Gerrans, 2006). Figure 6.2 shows a general model that generates understanding and predictions of mental states without assuming a specialized module for theory of mind.

The various aspects of this system are systematically interrelated. A core component of the system is attention and attention control. Leslie suggested that theory of mind is based on a selective attention-inhibition mechanism which directs the attention of the infant very early in life to attend to mental states such as belief, desire, and pretending, and to learn about them (Leslie, Friedman, & German, 2004). For instance, infants are attracted by the direction of another individual's gaze to an object or location relative to their own knowledge about this object or location, because this helps them predict the other's behaviour and interact with her effectively. Others suggested that this mechanism also calls on other general mechanisms such as recursion and metarepresentation, which allow inferences about mental states in the same way that they allow inferences about other states of the world, such as the biological and the physical world (to be discussed in the next chapter). Thus, in regard to the mind of others, this mechanism implements the human social instinct to interact with each other. Through the years it generates increasingly refined knowledge about one's own and others' mental states and their role in human actions and interactions. In fact a theory of mind that involves refined

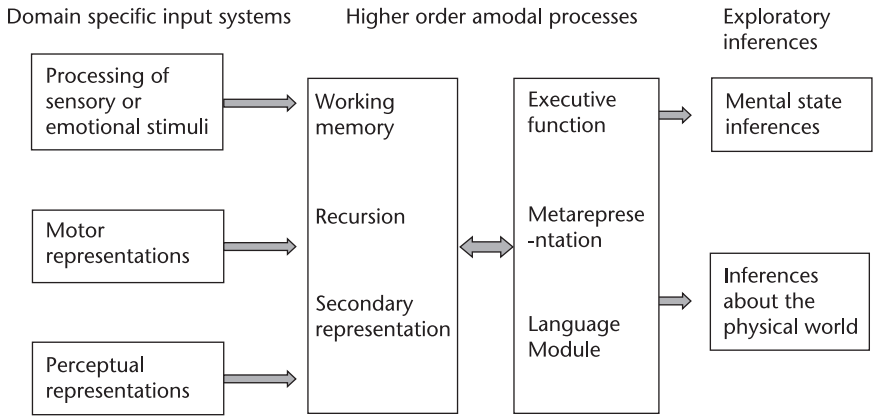


FIGURE 6.2 A model generating inferences about mental states without assuming a ToM module. A general metarepresentational capacity is assumed which uses representations delivered by lower-level mechanisms to generate inferences about states in the world, social (e.g., ToM), biological, or physical (Stone & Gerrans, 2006)

representations and attributions about other aspects of human existence, such as personality and emotionality, is the product of the functioning of this mechanism rather than its cause. We will discuss these relations later.

It is also noticed that there are large individual differences in the frequency of use of different types of inner experiences related to reflection, such as inner speech, inner seeing of visual images, and unsymbolized thinking, such as thinking a specific thought without the awareness that this thought is conveyed by words, images, or any other form of symbol. Some individuals never use these forms of "fixing" mental activities and others do so most of the time (Heavey & Hurlburt, 2008). There is very little developmental research on these phenomena despite their possible importance in intellectual development. However, there is evidence that differences between people in the ability for introspection relate to both self-consciousness and the ability to attribute mental states to other persons (Frith & Happe, 1999).

Self-reflection is necessary to have attention elevated to explicit awareness. It is clear that self-reflective awareness is present from late infancy. However, self-reflective awareness improves with age in both frequency and accuracy. Although initially overconfident and optimistic, with age it becomes more realistic as children gradually become better able to record their experiences and feelings of functioning. In the primary school years, children become increasingly able to evaluate if they have learned what they are supposed to learn; for instance, to recognize if they learned the meaning of kanji characters from the Japanese writing system. They can also become increasingly able to judge if they would be able to use what they learned now in new situations, or that their self-evaluation of learning is accurate vis-à-vis an independent evaluator, etc. (see Destan & Roebers, 2015).

Also, improvements in self-reflective awareness relate to the ability to control thoughts and actions (Lyons & Zelazo, 2011). Specifically, the increasing ability to

accurately record cognitive functioning and experiences and feelings generated by cognitive functioning enables children to increasingly revisit specific cognitive procedures, such as learning the meaning of symbols, words, or skills, in order to modify, adjust, and tune them to a pre-specified mental goal that is also explicitly represented. There is research showing that varying the representational requirements or the executive selection processes of false belief tasks influences the performance of college students and explains the difficulties that elderly persons have in dealing with theory-of-mind tasks (German & Hehman, 2006).

This line of research assumes that reflection and awareness drive executive control, which, in turn, drives the development of more complex processes, such as working memory, theory of mind, cognitive flexibility, and reasoning (Diamond, 2013; Zelazo, 2015). According to Zelazo (2015), the development of executive control is made possible, in part, by increases in the efficiency of reflective reprocessing which allow for increases in the hierarchical complexity of the rules that can be used to solve problems. Specifically, according to Zelazo's levels of consciousness (LOC) model, cognitive change comes from self-reflection which generates increasingly higher levels of awareness. These ". . . are brought about by a type of reflection or re-entrant processing that permits the contents of consciousness (i.e., our representations) at one level to be considered in relation to other contents at that same level, resulting in a more complex conscious experience" (Zelazo, 2004, p. 13). Lyons and Zelazo (2011) argued that these changes underlie changes in executive control and metacognition. However, Zelazo did not specify how his LOC relate to reasoning and other aspects of mental processing, such as working memory and intelligence.

Finally, changes in the self-awareness system also relate to self-concept. There is research showing that self-evaluation and global self-concept become increasingly accurate and refined with development (Harter, 2012). Recent evidence suggests that 4- and 5-year-old children already possess a representation of global self-worth that is defined in abstract terms and is differentiated from self-representations about specific characteristics, such as a specific school or sports-related activity. As a result, a failure in a specific activity may be justified in reference to situational variables and leave the general self-concept unaffected (Cimpian, Hammond, Mazza, & Corry, 2017). In fact, by middle childhood the self-system differentially relates to different realms of experience.

Along the same lines, a recent study showed that the difficulties of autistic children in shared attention and theory of mind relate to difficulties in self-categorization. Specifically, this study examined the ability of children to categorize themselves in reference to personality characteristics related to the Big Five factors of personality discussed in Chapter 18. They found that children who were high in autistic characteristics were low in the accuracy of self-categorization and shared attention. Accurate self-categorizations were related to high shared attention (Skoritch, Gash, Stalker, & Zheng, 2017).

A recent study involving 7- to 9-year-old children showed that, by the end of second grade, metacognitive control relates to executive functioning and

metacognitive monitoring relates to self-concept. Of these four constructs, executive functioning was found to relate to mathematics and both executive functioning and metacognitive control were found to relate to language. Moreover, over the span of one year from first to second grade, executive functioning at first grade predicted the state of metacognitive control at second grade. Self-concept at first grade predicted metacognitive monitoring at second grade (Roebers, Cimeli, Röthlisberger, & Neuenschwander, 2012). All in all, a central self-system generates awareness about the self which is also related to others via what was called the theory of mind.

Conclusions

The research reviewed above suggests some clear answers to the questions asked at the beginning of the chapter. Do children understand the mind as something of its own that differs from reality? They clearly do from a very young age, although this understanding develops and becomes more refined with age. They also understand that the mind is representational, generating representations for reality, depending on various sources, such as perception and learning from others. These representations are interpreted as causal origins of desires, beliefs, actions, and other knowledge. This understanding also develops throughout infancy, childhood, and adolescence. Finally, with age, individuals acquire an increasingly refined and differentiated knowledge of the composition and organization of the mind.

How and why does understanding of the mind develop? There have been several hypotheses explaining why awareness of the mind changes as children grow older; these are complementary rather than incompatible. The first ascribes development to the increased activation and functioning of one's own mind. That is, as they grow older children engage in activities and problem-solving which require them to activate different mental functions, often unsuccessfully. For example, when an unpleasant thought pops into their mind that they want to stop, children may realize that this is not always possible as the thought comes over and over again. Or, when asked to explain something to somebody, they may realize that they do not have all the information and skill necessary to do so (Flavell et al., 1995).

Later, in elementary school, children engage in problem-solving activities in different domains. For instance, they read, they do mathematics, they write stories, etc. These activities drive children to realize that each domain requires different mental operations, such as attention in reading, calculation in mathematics, memory in making up a story. On these occasions children gradually come to "see", so to speak, their actual mental processes as processes rather than just as products of the functioning of these processes. Thus they become sensitive to the presence of different functions and purposefully act to make them work efficiently. This implies that the development of theories and problem-solving about other domains of the world is conducive to the development of the theory of mind itself.

The second hypothesis stresses the social dimension of the discovery of the mind. According to this hypothesis, problem-solving in humans frequently occurs in

groups. Thus people have the opportunity to observe others trying to solve the same problem. This is especially the case in the world of the school, where children see each other trying to learn and solve problems in various domains. Of course, what is going on in another person's mind is completely private. However, in environments targeted to problem-solving, such as the school, children exchange experiences and they may check each other's representations and procedures. These experiences generate information, concepts, hypotheses, and models which gradually become more refined, focused, differentiated, and accurate (Demetriou & Efklides, 1985; Demetriou & Kyriakides, 2006). Thus awareness of the mind gradually gears on three assumptions: that the mind is (1) private but disclosable at will and in shades needed to obtain specific results; (2) complex, thus involving many different functions; and (3) constructive, and thus part of the reality one is dealing with.

The third hypothesis builds on and integrates the two hypotheses above. This relates to the role of awareness in the development of other processes. Specifically, as awareness of the organization and functioning of the mind grows because of the factors above, children become more proficient in using the processes they become aware of. For instance, knowing that controlling attention helps them to read better, commanding arithmetic operations helps them to calculate without errors, and controlling recall helps them to write better stories, children intentionally turn to these processes for the gains they offer. This becomes a self-development loop that drives the development of self-awareness, self-regulation, and the various domain-specific processes involved. By definition, then, knowing and controlling the mind becomes a domain-free process underlying intellectual development and individual differences in mental functioning and intelligence. We will return to these questions in the following chapters.

PERVASIVE MISUNDERSTANDINGS ABOUT LEARNING

How they arise, and what we can do

Misunderstandings about scientific findings can be the result of an honest desire to learn. Attempts at correcting misunderstandings can backfire, strengthening inaccurate beliefs.

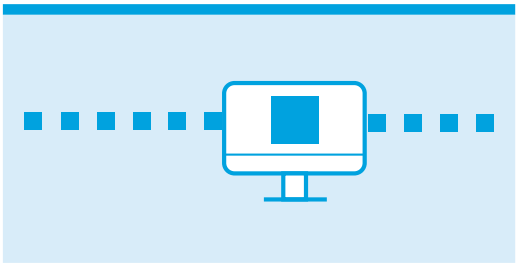
Based on various scientific disciplines (see Chapter 2), there's a lot we know about learning, and there's also a great deal we don't know. But who is the "we" in that statement? If a small, select group of scientists understand some process – say, the chemical reaction that occurs when neutrons collide – does that count as "known"? Or does it need to become part of everyday knowledge, such as the fact that the Earth is round? Scientists found this out, but now the average person also knows that the Earth is round – whereas in the neutron collision example, only a select few know the information. These two examples come from physics, but the same parallel can be drawn in learning: a small select group of scientists are trying to understand in detail how learning occurs in the brain, but all of us know that children are not innately equipped with knowledge about the world and need to be taught.

This is ok. We don't all need to know exactly how synapses operate in the brain; but what about a more general understanding of the mind? Isn't it useful to know that as soon as we encounter a piece of information, we immediately start to forget it? Or what about the fact that our memories are not like libraries, but instead reconstruct everything we try to retrieve? (For more about memory, see Chapter 7.) We think that type of information is useful – and on the whole, so do teachers. A survey of teachers around the world revealed that, overall, educators are highly enthusiastic about what cognitive psychology and neuroscience have to offer to education (Pickering & Howard-Jones, 2007).

Scientists are trying to understand in detail how learning occurs in the brain.

Overall, educators are highly enthusiastic about what cognitive psychology and neuroscience have to offer education.

The problem arises when information about learning – particularly about how learning occurs in the brain – is taken out of context and condensed into simplified overgeneralizations.



The problem arises when information about learning is taken out of context and condensed into overgeneralizations.

Once the message is passed down through various channels (from researchers, to journalists, to professional development workshops, to teachers), the science behind the "fact" often is lost, and the conclusion distorted.

Eventually, what started as a simplification or overgeneralization can turn into a slogan – and an inaccurate one at that. Indeed, a common term used to describe misunderstandings about the brain is "neuromyths." However, myths about learning and the brain typically start from a grain of truth, large or small. For this reason, we would rather not call them "myths," instead referring to them as "misunderstandings" or "misconceptions."

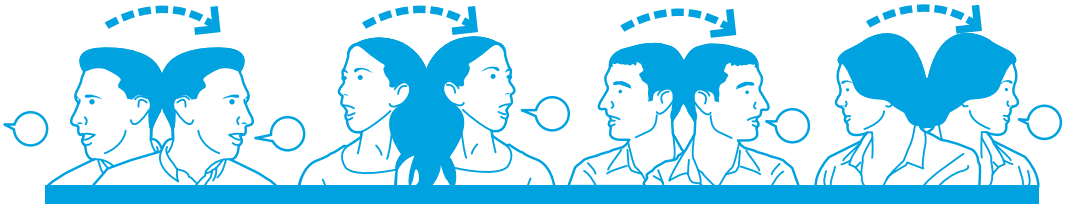
> *Misconceptions are beliefs that contradict the current state of scientific evidence.* (2017)

Annette Taylor

What are the most common misunderstandings? Two students in Yana's lab, Marcus and Shannon, sifted through 12 empirical papers that surveyed a total of 14,737 participants in 15 different countries, to determine which misunderstandings were most commonly believed across the world.

In the table opposite, you will see the ten most common misunderstandings about learning and the brain, along with the average percentage of study participants who believed each one.

Now, let's dig into three of these misunderstandings.



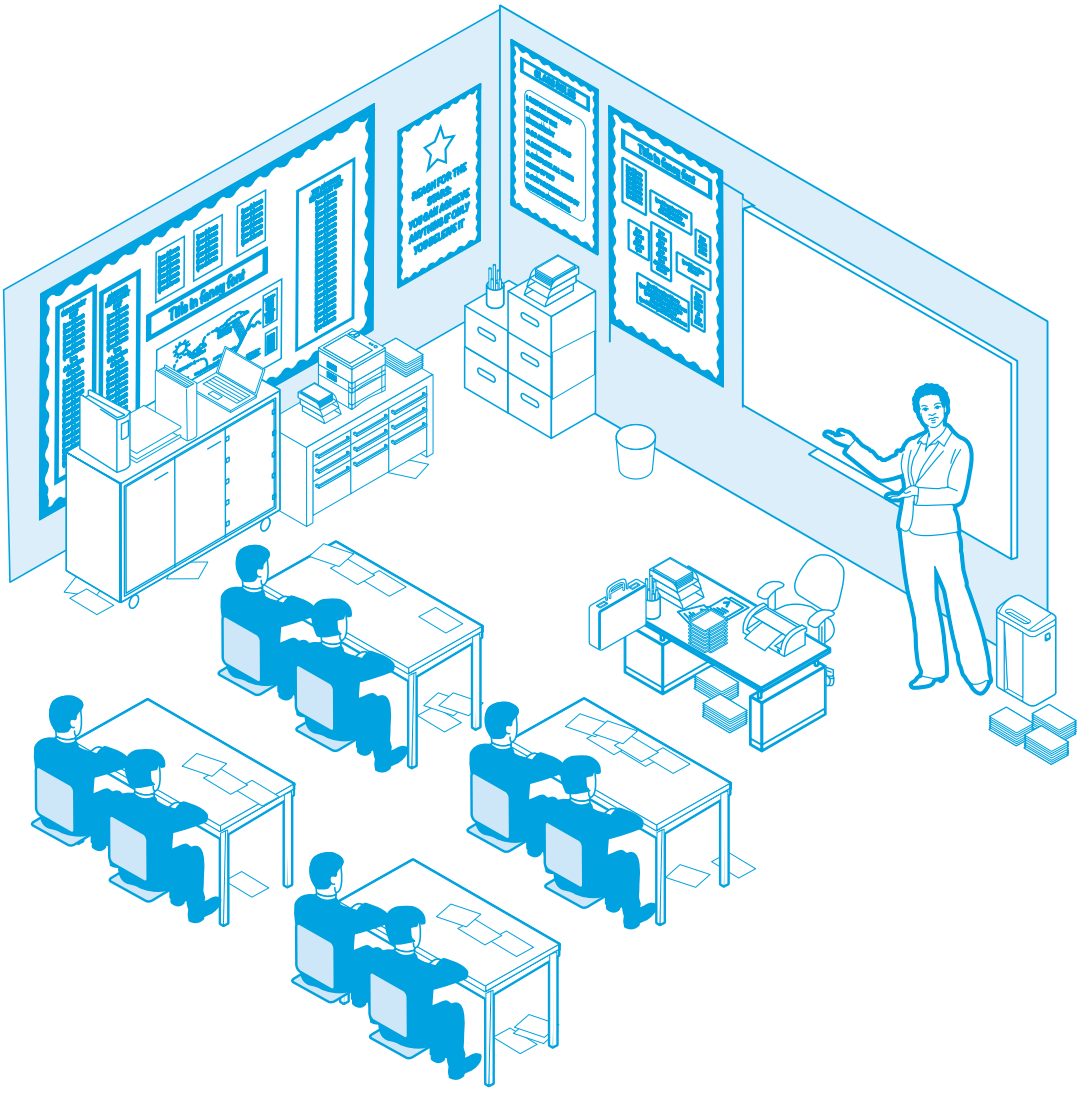
Rank	Misunderstanding	% who believe it
1	Individuals learn better when they receive information in their preferred learning style (e.g., auditory, visual, kinesthetic)	93%
2	Environments that are rich in stimuli improve the brains of pre-school children	89%
3	Short bouts of coordination exercises can improve integration of left and right hemisphere brain function	76%
4	Exercises that rehearse coordination of motor-perception skills can improve literacy skills	74%
5	Differences in hemispheric dominance (left brain, right brain) can help explain individual differences among learners.	74%
6	It has been scientifically proven that fatty acid supplements (omega-3 and omega-6) have a positive effect on academic achievement	61%
7	Emotional brain processes interrupt those brain processes involved with reasoning	60%
8	We only use 10% of our brain	49%
9	Memory is stored in the brain much like as in a computer: each memory goes into a tiny piece of the brain	48%
10	Children are less attentive after consuming sugary drinks and/or snacks	47%

The data in this table have been aggregated from the following studies: Deligiannidi and Howard-Jones (2015); Dekker, Lee, Howard-Jones, and Jolles (2012); Dündar and Gündüz (2016); Ferrero, Garaiza, and Vadillo (2016); Gleichgerrcht, Luttges, Salvarezza, and Campos (2015); Herculano-Houzel (2002); Hermida, Segretin, Soni García, and Lipina (2016); Macdonald, Germine, Anderson, Christodoulou, and McGrath (2017); Karakus, Howard-Jones, and Jay (2015); Papadatou-Pastou, Haliou, and Vlachos, (2017); and Pei, Howard-Jones, Zhang, Liu, & Jin (2015). Note that not all of the studies mentioned included each statement.

Shannon Rowley & Marcus Lithander

1) "ENVIRONMENTS THAT ARE RICH IN STIMULI IMPROVE THE BRAINS OF PRE-SCHOOL CHILDREN"

This belief describes the idea that young children should be exposed to many interesting things to see and explore, and often manifests itself as gaudy, "visually noisy" classrooms (Erickson, 2017).



Some of our everyday understanding about enriching environments may come from a misapplication of studies performed in other species (e.g., rats). A study from the 1960s found that rats deprived of stimulation had sparser connections between their neurons, and by word-of-mouth this could have led people to believe that humans needed an "enriched" environment in order to thrive (Diamond, Krech, & Rosenzweig, 1964). It is also possible that this belief stems from an overcorrection for the real findings that sensory deprivation leads to decreased learning (Vernon & Hoffman, 1956). However, true sensory deprivation is very extreme, and would involve putting a child in a situation where they cannot see, hear, or feel *anything*. Take the classic case study of Genie as an example of extreme isolation (Fromkin, Krashen, Curtiss, Rigler, &

Rigler, 1974). Genie was found in 1970, when she was 13 years old. She had been locked in a room by herself by her father, and was completely socially isolated. She spent much of her time tied to her crib or to a toilet chair. When child welfare found her, she could not talk. This is an extreme case of sensory deprivation, but demonstrates the type of deprivation that actually leads to a lack of development.

The reality is that in their everyday lives, even without decorated classrooms, children encounter sufficient information to enable their brains to develop normally. In fact, overly decorated classrooms can actually lead to a decrease in learning relative to more sparsely decorated classrooms, due to potential for distraction (Fisher, Godwin, & Seltman, 2014). Colorful decorations can lead children to shift or split their attention away from the teacher and the current learning tasks, and this can interfere with learning (see Chapter 6 on attention).

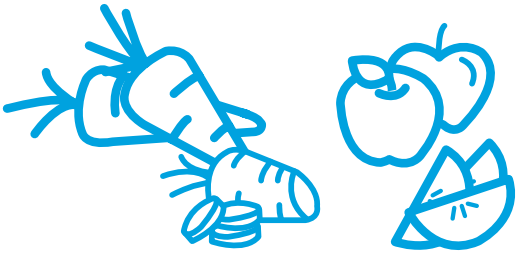
We may put children in visually noisy learning environments because we misunderstand their need for stimulation.

2) "INDIVIDUALS LEARN BETTER WHEN THEY RECEIVE INFORMATION IN THEIR PREFERRED LEARNING STYLE (E.G., AUDITORY, VISUAL, KINESTHETIC)"

There is currently no solid evidence from controlled experiments to suggest that teaching in someone's preferred modality (e.g., auditory) will help them learn. And yet, a lot of people hold on to the idea that learning styles are important and meaningful. Where does this misunderstanding come from?

A lot of people hold on to the idea that learning styles are important and meaningful.

It's likely that the idea comes from an obvious truth: that individuals have *preferences* about the way they study. This is non-controversial; it would be strange to deny the existence of preferences, since we all have them. But where the overextension happens is where people immediately assume that these preferences should be honored in order to maximize learning. Think of the following nutritional analogy: let's say one person likes apples, while the other person likes carrots.



Now let's imagine we measure out 100 calories' worth of apples and carrots, and have these two people eat either their preferred food, or their nonpreferred food, on top of what they normally eat, every day for a month. We then measure how

much weight they gained (assuming they were maintaining their weight with their own caloric intake). Will they put on a different amount of weight depending on whether they ate their preferred or nonpreferred food? No. They are taking in the same number of calories regardless of whether they like or dislike the food. At the same time, carrots and apples contain different nutrients, so ideally, people would be eating a mix of both!

Learning styles seem impossible to get away from. Indeed, surveys conducted across the world typically find that over 90 percent of teachers believe in adapting teaching to each student's preferred learning style. This statistic in and of itself might not be surprising, but the more surprising result is that greater interest in the neuroscience of education tends to be related to stronger – rather than weaker – beliefs in learning styles (Dekker *et al.*, 2012)! Why is this the case? A review of the literature (Newton, 2015) suggests that one factor may be the proliferation of research that uses learning styles questionnaires and then concludes that learning styles are important and useful (without actually demonstrating this in a scientifically sound manner). Any well-meaning teacher who searches the literature is thus going to find many positive references to learning styles. Having said that, another survey did find that taking multiple classes about neuroscience reduced the belief in this idea, which is at least somewhat reassuring (Macdonald *et al.*, 2017).

The thing is, the explanation for why we can't conclude that learning styles are useful based on any of the published data is actually quite nuanced (Pashler, McDaniel, Rohrer, & Bjork, 2009). In order to understand why learning styles aren't useful, teachers would need to invest quite a lot of time in understanding the research methods involved in the studies that claim to demonstrate their usefulness. So, what we need is more open-access, clear explanations of the research. These can include more traditional academic articles (Kirschner, 2017), but also popular science materials such as videos (https://ssec.si.edu/sending-learning-styles-out-style) and blog posts (www.learningscientists.org/blog/2017/5/25-1).

The most ironic thing about learning styles is that even if learning styles *did* matter for learning, a better idea would be to teach to students' nonpreferred styles, in order to strengthen their weaknesses.

3) "SOME OF US ARE 'LEFT-BRAINED' AND SOME ARE 'RIGHT-BRAINED' AND THIS HELPS EXPLAIN DIFFERENCES IN HOW WE LEARN."

The other day, I (Yana) gave students in my First Year Experience Seminar a quiz that included true and false statements about learning and the brain. It wasn't for points or anything – I was trying to gauge where the students were, and use the quiz as a jumping-off point for discussion. A lot of students said they believed this statement about the left and right brain. When I asked why they believed this, I received an alarming answer from one student: "My teacher told me."

It is undeniably true that humans have two brain hemispheres. Also, there is scientific evidence (from brain-damaged patients as well as more modern neuroimaging techniques) to suggest that some types of tasks might use more resources from one hemisphere than the other. A good example of this is language, which tends to use more resources from the left hemisphere than the right (Springer & Deutsch, 1998). However, what is NOT true is that individuals can be "right-brained" or "left-brained," or that the former is "creative" while the latter is "rational." This is a misunderstanding of how the brain works: just because some tasks require more resources from one hemisphere, does not mean individuals differ in terms of their brains.

Just because some tasks require more resources from one hemisphere, does not mean individuals differ in terms of their brains.

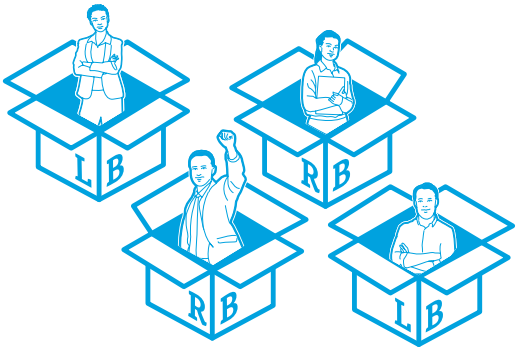
Even if there were subtle differences between individuals at the level of brain hemispheres, there is no evidence that any of the "left/right brain questionnaires" that pop up frequently on social media would possibly pick up on these differences in any kind of meaningful way. Not to mention the complete lack of relevance of these potential subtle differences to education, contrary to what some for-profit training agencies will claim, e.g., http://kidgeniusapp.com/ – "an application for right brain training," $199/year. Hence, many neuroscientists have come to call this the "left/right brain myth" (Goswami, 2006).

Another important point is that even if some tasks use more resources from one hemisphere than the other, there is no task that exclusively relies on only one hemisphere. As Dr. Melina Uncapher put it,

Melina Uncapher

"Every complex cognitive function is a result of the engagement of a network of multiple regions, distributed throughout both hemispheres, acting in coordinated ways. (2016)

Why do people believe this idea? Actually, it's not too different to the issue of learning styles. Since individuals tend to have preferences for certain types of tasks, some find it appealing to label people as "left-brain" or "right-brain" thinkers. For example, if someone likes math, they might be labeled a "left-brain" thinker, whereas if they are good at art they might be classified as a "right-brain" thinker. These categorizations do not serve us well, as they simply push people into boxes and can become self-fulfilling prophesies, preventing the development of novel interests.

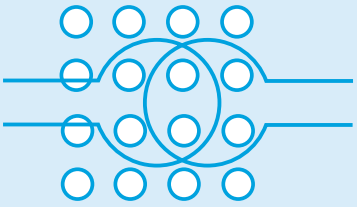


You can read more about this misunderstanding in Melina Uncapher's guest post on our blog (Uncapher, 2016).

MISUNDERSTANDINGS MAY ARISE FROM AN HONEST DESIRE TO LEARN

It is important to emphasize that these misunderstandings do not arise simply because teachers are not paying attention to neuroscience or don't want to learn. In fact, the opposite is true; teachers on the whole find neuroscience useful and important to understand, and find it interesting to explore and learn about (Pickering & Howard-Jones, 2007). However, there is a complex relationship between familiarity with neuroscience and the brain on

a basic level, and accurate understanding of the nuances involved.



The relationship between interest in neuroscience and accurate understanding of learning is complex.

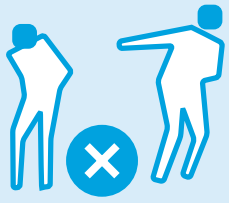
That is, an active interest in neuroscience unfortunately does not translate into the ability to distinguish between accurate and inaccurate statements about learning and the brain. On the contrary, multiple studies have found small but significant *positive* correlations between accurate general knowledge about the brain and belief in misunderstanding or "neuromyths" (Dekker *et al.*, 2012; Gleichgerrcht *et al.*, 2015).

In some cases, those most interested in neuroscience can be more susceptible to believing incorrect information.

That is, to some extent the more a non-expert is curious about neuroscience, the more likely they are to be led astray by what they read! Somewhat reassuringly, a recent study did show that actually being a neuroscientist drastically decreased the likelihood of believing in misunderstanding about the brain (Macdonald *et al.*, 2017). That's a relief!

WHAT CAN WE DO TO HELP CORRECT THE MISUNDERSTANDINGS?

Let's say you've understood why it is not a good idea to put up too many decorations in a learning environment, but others believe that visual stimulation is important for learning, and don't believe you. Unfortunately, simply providing people with accurate information is often not enough to combat misunderstandings, and can sometimes even create the opposite effect where people dig in to their inaccurate beliefs (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012; Pershan & Riley, 2017).



Shaming people for their beliefs is not an effective way to change minds.

Much research has gone into figuring out the most effective way to correct misunderstandings in an educational setting. One effective technique is called "refutational teaching," and involves the following key stages: facts, refutation, and inoculation (Guzzetti, 2000; Lassonde, Kendeou, & O'Brien, 2016). That is, first of all, you need to start with the correct information (in this case, visually noisy environments lead to distraction and can decrease learning). After that, you would

present the misunderstanding – for example, "some people believe that a visually stimulating environment can help children learn, and that this means that classrooms should include lots of bright decorations." Now comes the refutational stage: explain *why* this is not true (see Chapter 9 for more about using "why" questions to increase understanding). Here you would bring in the evidence, referring back to the original factually correct statement. Finally, you can now "inoculate" your audience against the incorrect information, by reminding people of the types of incorrect arguments that tend to come up and how you can refute them. For instance, an argument for visual stimulation in the classroom might be "but children do not learn when they experience sensory deprivation." In the inoculation phase, you would remind your audience that this claim only applies to extreme sensory deprivation, rather than lack of bright pictures in a classroom. You can read more about this method in Annette Taylor's guest post on our blog (Taylor, 2017).

The most important thing is to focus as much as possible on the correct information, rather than repeating the misconception over and over again. That repetition could actually *increase* beliefs of the misunderstanding by causing it to feel more familiar (Lewandowsky *et al.*, 2012; Skurnik, Yoon, Park, & Schwarz, 2005) and making it more memorable in the long run (Peter & Koch, 2016). That's why we have made sure that as you continue to read this book, you will learn about the basic processes of perception, attention, and memory as they are currently understood by cognitive psychological scientists, along with learning strategies that have received decades of evidence to support their effectiveness.

CHAPTER SUMMARY

Unfortunately, misconceptions about ways to improve learning are pervasive in education. For example, it is commonly believed that children in pre-schools need a highly stimulating environment in order to learn best, including many attractive visuals hung on the walls. The research actually shows that while children do need some stimulation, an overload can hinder learning. In this chapter, we discussed why this and other misconceptions have become so pervasive, and why we need to work hard to overcome them, and how we can best do that.

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Chapter 1

Theories and Theorists

Jane Johnston and Val Wood

'Our highest human endeavours must be to develop free human beings who are able of themselves to impart purpose and direction to their lives'
Steiner (1996)

Introduction

This chapter seeks to chart the emergence of influential theories on practice and policy in **early childhood** education and care, from the early eighteenth century onwards. Taking a chronological approach, it can be seen how the work of the earliest **theorists** and reformers impacts upon the work of the future generations of pioneers. Brief biographical details have been included to provide further insight into how experiences in their lives could have potentially influenced their work. In addition

to providing factual details, the chapter also includes common themes and links between the theorists. Explicit connections are made between the work of the theorists and current early childhood practice and policy.

Aims

- To provide an overview of historical practice and provision in the early years through the work of early pioneers and reformers
- To provide key biographical details of the lives of these pioneers and reformers, in an attempt to understand the influences on them that have helped to formulate their beliefs
- To examine the key historical beliefs held by these pioneers and reformers and consider their influence on current practices and policy in early childhood education and care
- To consider recent, new and emerging theories and theorists emphasising the current issues in Early Childhood Studies, both nationally and internationally

A timeline of theorists

We start our timeline (see Table 1.1) with **Jean-Jacques Rousseau (1712–1778)**, who was a French 'philosopher, social and political theorist, musician, botanist, and one of the most eloquent writers of the Age of Enlightenment' (Dent, 2005). Rousseau was born in Geneva on 18 June 1712 and raised by an aunt and uncle, as his mother died just after his birth. At 13, Rousseau was apprenticed to an engraver, but ran away after three years and became a companion and secretary to Madame Louise de Warens. It was here that Rousseau was influenced in his thinking. In 1742 he went to Paris and worked as a music teacher, music copyist and political secretary, becoming a close friend of the French philosopher Denis Diderot. Rousseau believed that childhood was distinctly different from adulthood. His ideas are based on the philosophy that humans are born free and good, but are influenced by society and its conventions and through the process of socialisation, and that children have a different way of thinking to adults. Children were thought to develop inhibitions, vices and ideas during their childhood and to become increasingly constrained by the rules of society. Rousseau stressed that young children should be allowed to develop free of society's constraints and that early provision should provide a balance between societal freedom and happiness on one side and increasing independence and control on the other (Roopnarine and Johnson, 1987). Rousseau believed that education should '*accommodate itself to the child*' (Barnard, 1961: 33) rather than expecting the child to accommodate to the system, convincing educators that education should be child-centred, with expression, rather than repression, being central (Rousseau, 1911). Elements of Rousseau's principles

have dominated early education for over 200 years and he has been called the 'Father of Education'. It is reasonably undisputed that his philosophy led to the understanding that practical development in the early years (experiential learning) was most effective, and to the child-centred education in the UK in the 1960s and 1970s.

Our second **reformer** and thinker is **Johann Heinrich Pestalozzi (1746–1827),** a Swiss humanitarian and educational reformer, whose theories are thought to have been influential in the development of elementary education worldwide. Pestalozzi was born in Zurich on 12 January 1746 and studied theology at the University of Zurich, intending to become a pastor. However, he was most concerned with the plight of the poor, and in 1775 opened a school for the children of the poor on his estate near Zurich and another for orphans in 1798, both of which were not open for long because of financial difficulties. In 1799, Pestalozzi was more successful when he opened a school at Burgdorf, which was moved to Yverdon in 1805 and was attended by pupils from all over Europe. This school was a testing ground for many of his ideas. Pestalozzi stressed the individuality of the child and believed that children learn through practice and observation 'through the natural employment of the senses' (Silber, 1960). Like Rousseau, he stressed experiential learning and went on to identify that teachers should facilitate learning rather than impart knowledge to children. His beliefs have influenced not only elementary (primary) education throughout the Western world, but also teacher training in the UK, especially in the 1960s and 1970s.

Table 1.1 Pioneers and reformers in early childhood education

Rousseau, J.J.	(1712–1778)
Pestalozzi, J.H.	(1746–1827)
Oberlin, J.F.	(1740–1826)
Froebel, F.	(1782–1852)
Dewey, J.	(1859–1952)
Montessori, M.	(1870–1952)
McMillan, R.	(1859–1917)
McMillan, M.	(1860–1931)
Steiner, R.	(1861–1925)
Freud, S.	(1856–1939)
Piaget, J.	(1896–1980)
Vygotsky, L.S.	(1896–1934)
Erikson, E.	(1902–1994)
Skinner, B.F.	(1904–1990)
Bowlby, J.	(1907–1990)
Maslow, A.H.	(1908–1970)
Plowden, B.D.	(1910–2000)
Bruner, J.	(1915–2016)
Bronfenbrenner, U.	(1917–2005)

Table 1.1 *Continued*

Malaguzzi, L.	(1920–1994)
Bandura, A.	(1925–)
Kohlberg, L.	(1927–1987)
Weikart, D.P.	(1931–2003)

Reflective Tasks

Experiential learning

Level 1

Consider Rousseau's and Pestalozzi's belief in experiential learning. What do you consider experiential learning to be? Identify which of the following would be part of experiential learning:

- finding out for yourself;
- being taught something;
- learning through your own experience;
- thinking through a problem;
- being supported by another person (adult or peer);
- learning through practical activities;
- discussing with others;
- learning from a book or the media.

Think about a positive learning experience you have had.

- What made it so positive?
- Was it experiential?

Level 2

Think of a successful learning experience you have provided for children.

- What were the features that made it successful?
- How could you have made the experience more experiential?
- Would this have made it even more successful? Why?

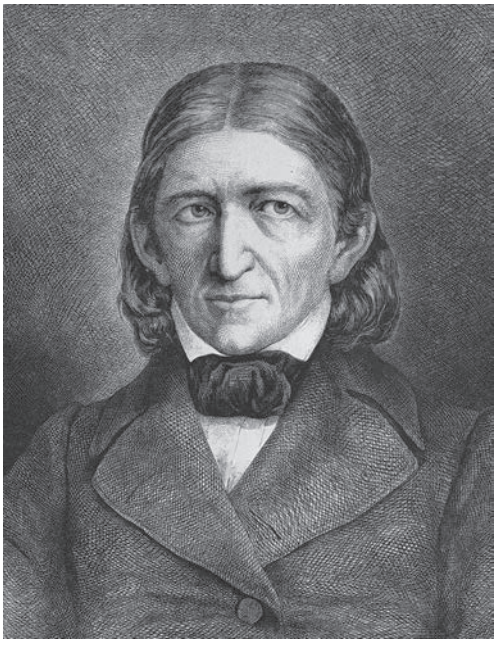
Level 3

Consider the future planning of your setting.

- Does it contain aspects of experiential learning?
- How can you work with your staff to develop the planning further to enhance children's experiential learning?
- Why might this be beneficial to the children?

Jean Frederic Oberlin (1740–1826) is a little known and probably under-rated reformer. He was a French educator who instituted a system of pre-school education which focused on language development and handicrafts, but had a varied and balanced curriculum, with some instruction, physical exercises to aid cooperative skills, handicrafts and no lesson plans or timetable. In 1767, together with three collaborators, Madeleine-Salome Oberlin, Sarah Banzet and Louise Scheppler, he set up a system of pre-school education and founded schools, which became known as the knitting schools, in poor villages in rural Alsace. At that time in rural areas, standard French was not commonly spoken, and while this adversely affected his work it also characterised his system of learning. In the schools, groups of about 50 children sat around a leader while she knitted and chatted, teaching them names of objects, plants, animals, etc. in standard French. In this way, the children learnt from the leader, who modelled speaking and listening and taught them about the world around them in an open and cheerful way. Oberlin also introduced a system for learning to read which was a form of early paired reading, where children would listen to stories, look at illustrations and later read the text for themselves. His ideas and the practice in his schools formed a model for early education in France and he appears to be the first person to recognise the importance of a varied and balanced curriculum. His ideas were not adopted in France during his lifetime and his schools did not continue after his death in 1826, but today's provision for young children equally considers the importance of a varied curriculum and engages in group work to support developments such as literacy.

Friedrich Froebel (1782–1852) (see Picture 1.1) was a German educator who is widely recognised for his contribution to early childhood theories and practice. He was born in Oberweissbach in Germany on 21 April 1782 and was mainly self-educated, but undertook a university education in Jena, Göttingen and Berlin. He worked in forestry, surveying and architecture before becoming a teacher and was greatly influenced by Pestalozzi, with whom he worked from 1806 until 1810. In 1816 he founded a school called the Universal German Educational Institute. His ideas for the education of pre-school children, aged between 3 and 7, led to the first schools for pre-school children, which he called 'kindergarten' (children's garden). These kindergartens stressed the natural growth of children through action or play, as 'the purpose of education is to encourage and guide' (Froebel, 1826). Froebel's ideas were considered very radical for the time and largely rejected publicly; kindergartens were even banned in Prussia from 1851 to 1860. After his death in 1852, his ideas blossomed and kindergartens were established throughout Western Europe and the USA and later throughout the world, so that he is now considered to have made an enormous contribution to education. As well as the importance of play, Froebel's legacy included the notion



Picture 1.1 Friedrich Froebel
Source: Bildagentur-online/Getty Images

of practical experiences through the exploration of special materials, which Froebel called 'gifts'. These were a range of educational toys, such as shaped wooden bricks and balls, designed to develop a child physically and cognitively. Such educational toys are extremely common today, but this was a radically new idea in the early nineteenth century. Froebel also developed a series of educational activities, which he called 'occupations', and was very concerned about the education of young children through educational games in the family. Current practice involves the use of finger rhymes, nursery rhymes and educational songs, which are all used regularly with children from birth to aid social, cognitive and physical development.

Practical Tasks

Games, songs and rhymes

Level 1

Add to the list of rhymes and songs below:

Incy wincy spider

One, two, three, four, five, once I caught a fish alive

Round and round the garden, like a teddy bear
Here we go round the mulberry bush
We're going on a bear hunt
The wheels on the bus go round and round
Heads, shoulders, knees and toes
Each peach, pear, plum, I spy Tom Thumb

Identify which ones will develop a child physically, mathematically or linguistically.

Level 2

List all the games, songs and rhymes that will develop mathematical understandings and skills. Identify how you can use them to develop children mathematically.

Level 3

Make a new game for children which will develop them mathematically or linguistically. This could be a magnetic fishing game, with basic key words written on the back of the fish, or a game of snap with numbers and objects on the backs of the cards (number 5 on one and five apples on another). Tip: Laminate the game to make it more durable. You can also add words, numbers, etc. after lamination, with a dry marker, and then you can make the game more or less difficult.

John Dewey (1859–1952) was an American philosopher, psychologist and educator who was interested in the reform of educational theory and practice. He studied at the University of Vermont and Johns Hopkins University. Throughout his career he lectured in education, acted as an educational consultant and studied the educational systems of China, Japan, Mexico, Turkey and the Soviet Union. Dewey opposed authoritarian methods of education, feeling that children should not be kept occupied or trained as that did not prepare for a democratic life. However, he did advocate guidance to support the child's development and preparation for this democratic life (Dewey, 1916). We can see this belief reflected in today's society as we are expected to support children in their decision-making and in developing aspects of citizenship through both the Early Years Foundation Stage (DfE, 2014) and Key Stage 1 (DfE, 2015). It is interesting to contemplate how Dewey's ideas about education, not just about keeping children occupied, fit with current initiatives for extended schools, the development of an early years foundation stage from birth to five years and the debate about whether care at home or care in pre-school settings is best for development.

We can see evidence in Dewey's ideas from other reformers and theorists. For example, Dewey followed Oberlin's belief in a varied curriculum and formulated educational principles which emphasised learning through varied activities rather than a more formal curriculum. He also followed Rousseau's belief in child-centred childcare and began a shift from school-centred education towards more child-centred education, with his work and writings responsible for changes in **pedagogy** (the science of education) within the USA in

Picture 1.2 A Montessori nursery, showing children taking part in practical activities to engage the senses
Source: Jeff Gilbert/Alamy Stock Photo

the twentieth century. His ideas have been linked to progressive changes in education and he showed how philosophical ideas can work in practice.

Maria Montessori (1870–1952) was an Italian educator and physician who is best known for her method of teaching young children (see Picture 1.2), the Montessori Method (Montessori, 1912). She was clearly a remarkable woman; she was the first female medical doctor in Italy, who was only accepted at medical school by appealing to the Pope (Kramer, 1976), and an unmarried mother, whose experiences, background and observations led her to develop firmly held beliefs about early childhood. She believed that each child was an individual with a unique personality and needed protection from adverse influences during childhood. These adverse influences included adult intervention, as she believed that adults hindered the child developing as an explorer, discoverer and manipulator of the environment. It was the role of adults to observe and support development. She was committed to a child-centred approach to childhood development, which involved child-sized furniture, a motivating environment and activities which supported, promoted and even accelerated all aspects of development.

The principles of the Montessori Method (Montessori, 1912) are:

- early childhood should be child-centred but not child-led;
- there are five disciplines (practical, sensorial, language, mathematical, culture) and these are not sequenced and overtly separate;
- activities should satisfy the child's changing developmental needs and build upon each other;
- 'indirect preparation' should be built into the sequences (periods) of activities;
- there are seven periods during childhood;

- teachers should provide direction and structure;
- children determine their own rate of progression.

Children start in the first period by engaging with early practical activities and introductory sensorial, language and cultural activities. Today we can relate this to child development knowledge and early years education with children up to a year old focusing on listening, looking, learning, reaching out, crawling, pulling up and standing (DfE, 2014). In the Montessori Method (Montessori, 1912), the early activities are developed in the second period by building on fundamental practical, sensorial (focusing on sight and sound), language and cultural skills. Olaf (2003) likens this to the young child from 1 to 3 years of age participating in family life, experiencing food, toys, puzzles, music and language. Montessori's third period develops more advanced practical skills, building on the existing fundamental sensorial skills (focusing on smell, sound and taste) and completing preparatory work in language, as well as fully entering culture work and starting mathematics. This relates to the period when children develop as part of a family and explore food, toys and games, and blocks and puzzles, as well as explore and care for their wider environment through interaction with the earth, plants, animals, people, language, music and art (Olaf, 2003).

Rachel McMillan (1859–1917) and her sister **Margaret (1860–1931)** were both born in New York but moved to Scotland during childhood. They were both committed to social welfare and reform of provision for young children. Rachel trained as a sanitary inspector and social worker, while Margaret trained as a governess. In 1908 Rachel opened a school clinic, followed in 1911 by an open-air nursery school in Deptford. Here, children aged between 2 and 5 would spend all day and be provided with meals. Margaret continued Rachel's work after her early death from cancer in 1917, opening the first nursery schools across the UK where caring was a central aspect. Indeed, the word 'nurture' was first coined by Margaret McMillan. Both Rachel and Margaret McMillan (1911) recognised the importance of a healthy body as well as a healthy mind in childhood. As Margaret wrote, without education and nurture in the first years, 'all the rest of life is clouded and weakened' (McMillan, 1930). They identified that education is more effective when children are well fed and clothed and when it takes place in an environment that protects the child's health and welfare. They also established training colleges to prepare staff for work in nurseries; the Rachel McMillan Training College and nursery school in Deptford and Bradford are both now merged with higher education institutions.

Margaret McMillan also placed a high value on the education of the imagination, identifying that creativity was an important aspect of early development, but could only progress if safety, health and welfare were adequately considered.

Study Skills

Selecting and using literature

In this chapter, the Study Skills we are developing involve choosing appropriate reading to support your understanding and using that reading effectively in oral and written arguments. The first step in this area is to make appropriate choices in the type of

literature, using a few appropriate secondary sources of reading, which should also be a balance of books, journals, policy documents and web-based sources, avoiding over-reliance on one type. This balance is important as over-reliance on one type of text will weaken any argument you are trying to make. For example, over-reliance on policy documents just reiterates government policy and does not show understanding of the tensions that exist between policy, practice and research. Over-reliance on web-based texts does not take into consideration the validity of the text and you may be reiterating the subjective view of the author. Over-reliance on research does not help to consider the implications of the findings on practice and provision and future policy making.

Appropriate reading involves choosing texts that help you to understand the issue you are researching and that can support the claims and counter-claims (arguments) you are making. Once chosen, reading should be for understanding rather than collecting lots of interesting titbits to quote, as this does not show understanding and tends merely to describe reading rather than use it effectively. This is critical reading and often involves reading and rereading to fully understand the meanings of the text. As you do this you should make notes from the reading, including a note of the full bibliographical reference. In this book we use the Harvard system of referencing, which involves putting the name(s) of the author(s) and date in the text, and showing page numbers if you use a direct quotation. Full references should be made at the end of the piece of writing:

Name, initial. (date) *Title of Book.* Place of publication: Publisher

Name, initial. (date) 'Title of article', *Title of journal,* Volume(Issue): Pages

Name, initial. (date) 'Title of chapter', in name of editor, initial, *Title of book*. Place of publication: Publisher, pages

At the end of this chapter, you will find references which illustrate how this works in practice.

When reading and referencing reading, you should always use original sources and they should always be read and referenced, rather than simply referencing texts that have been used within the book you are reading. This is necessary not only for scholarly purposes and because it aids understanding of the original ideas and arguments, but also because you need to check that the details of the original author and the reference are correct.

The notes that you make on your reading can be used to support arguments you are making. Effective use of reading involves making persuasive arguments and using reading to support them, rather than simply citing reading, as this shows an understanding of the issues through analysis of the ideas expressed in the text rather than a description of them. This is discussed further in the Study Skills in Chapter 11. As the skill of using reading develops, then you need to use literature to create critical arguments.

Study Skills Tasks

The beliefs of Maria Montessori and Margaret McMillan are well published, both in their own writings and in the writings of others.

Level 1

Find one book on either Maria Montessori or Margaret McMillan and read about their beliefs.

Level 2

Find one book written by either Maria Montessori or Margaret McMillan and one book written about them. Read both the books and compare the ideas expressed.

Level 3

Find one book which contains the beliefs of Maria Montessori or Margaret McMillan and another which critiques their beliefs. Read them both and compare the ideas expressed.

Study Skills Tasks

Selecting and using literature

Level 1

Find a current book which advocates play for effective development. Compare the ideas with those of the theorists and reformers who have advocated play (Froebel, Steiner, Vygotsky or Plowden).

Level 2

Read the part of the Plowden Report (DES, 1967) which describes discovery play and compare with the ideas in a more recent book on play.

Level 3

Read what Froebel (1826) and Plowden (DES, 1967) have to say about play and compare with the views of two modern writers.

Reflective Tasks

The beliefs of Montessori and McMillan

Level 1

Consider how the beliefs of either Maria Montessori or Margaret McMillan are seen in today's early childhood practice. Make a list of practices today which could be attributed to their beliefs.

Level 2

Identify aspects of the practice in your setting which can be attributed to the beliefs of either Maria Montessori or Margaret McMillan.

- How did these experiences relate to the beliefs of Montessori or McMillan?
- How did these experiences support or hinder early development?

Level 3

Reflect on aspects of the practice of your setting which can be attributed to the beliefs of either Maria Montessori or Margaret McMillan. From your experience, identify how these aspects of practice have supported child development in your context. How could you develop these aspects further?

Picture 1.3 Rudolf Steiner
Source: Heritage Images/Getty Images

Rudolf Steiner (1861–1925) (see Picture 1.3) was a philosopher and scientist, born in part of Austria which is now in Croatia. He studied natural sciences at the University of Vienna and evolved the philosophical doctrine of anthroposophy, which focuses on disciplined inner activity and identifies the importance of the human being rather than God. In 1912, Steiner founded the Anthroposophical Society and, in 1913, the Goetheanum,

a school of spiritual science, to advance his educational methods. These methods are based on Steiner's philosophy, which advocates the importance of spiritual growth and holistic education. He believed that education involves supporting the unfolding of three human faculties:

- doing, associated with the hands;
- thinking, associated with the head;
- feeling, associated with the heart.

These followed the natural rhythm of life and engaged with the natural world. Like Montessori, Steiner cherished the unique individuality of every child. In Steiner's educational methods, nothing is rushed; there is nothing to fear since the natural rhythm is followed; nothing fails and children are allowed the satisfaction of experiencing and learning through play; there are no instructions, but rather self-direction with the teacher as a role model (Oldfield, 2001). Each session for young children will follow a rhythm of expansion and contraction. For example, the session may begin with a creative activity (painting, drawing, modelling, baking or cleaning), which allows expansion, followed by tidying up and circle time (a contraction time). After washing hands and having a snack and drink, children will have outdoor play time (expansion time) and finish the session with a story-time or puppet show (contraction time). There is also a weekly rhythm, with each day of the week having specific identified activities, and so there is no uncertainty or surprise for the child. Steiner also believed that children should not be forced into formal learning at an early age and that education involves developing purpose and direction (Steiner, 1996), in seven-year phases, with children not being, he felt, ready to learn to read until they have completed the first phase at 7 years of age.

Sigmund Freud (1856–1939) was an Austrian physician and the founder of the psychoanalytical perspective. Freud developed his theories from working with troubled adults with a collection of nervous symptoms that appeared to have no foundation in the physical, and he believed that the way in which they managed their sexual and aggressive drives in the early years affected healthy personal development as adults. There are two main aspects to Freud's theories:

1. The development of personality, which Freud (1923) believed has three parts, the id, ego and super ego. The id dominates early life and behaviour and is a primitive, logical and totally demanding part of personality, focusing on things which give pleasure, such as food and comfort. The ego is a more realistic awareness of self and the world, which develops with the child. The superego is a more developed part of personality which involves moral reasoning. These ideas are discussed further in Chapter 6.
2. Psychosexual development, which stresses the importance of early childhood relationships for healthy development, linking early sexual behaviour to parts of the body (oral, anal and genital) and the difficulty of balancing the basic needs in early childhood.

Freud's theories have received much criticism for three main reasons: because of the emphasis on sexual feelings in early development; because his theories failed to take into account cultural influences and could not be applied in other contexts; and because he developed a theory of childhood by studying adults. However, his theories remain important because they were the first theories which recognised the importance of early experiences on future

adult life and development, and also because they were developed and modified by other psychoanalysts, such as Anna Freud and Erik Erikson.

Jean Piaget (1896–1980) (see Picture 1.4) was a Swiss developmental biologist who became interested in **psychology** and through studies of his own children identified four stages of cognitive development (Piaget, 1929; 1950):

- *pre-operational*, which is the earliest stage of **cognition** and is characterised by reflexive movements in response to stimuli and the development of early ideas as a result of experiences;
- *sensori-motor*, during which children develop their early ideas, including mental imagery and thinking skills, although their thinking is very uncoordinated and irrational. It is also during this stage that language develops;
- *concrete operational*, which is a stage characterised by increasingly rational and coordinated thinking as long as the child is working concretely, that is, manipulating objects to aid understanding;
- *formal operational*, where thinking becomes more abstract and logical and children are able to solve mental problems.

Picture 1.4 Jean Piaget
Source: Bettmann/Getty Images

Piaget's cognitive theories and those of other cognitive psychologists are discussed more fully in Chapter 4. His theories, and the work of other theorists, began an intense focus on cognition which has helped us to understand the way a child thinks. Piaget's work has been extensively criticised over the years by those who continued to work in the area, such as Lev Vygotsky (1962) and Robbie Case (Case and Okamoto, 1996). Some of his findings were found to be incorrect, especially with regard to the ages at which children develop cognitively; see, for example, Berk's comparisons of developmental milestones (2003) with Piaget's stage theory. Piaget also posited theories about moral development (Piaget, 1965), which evolved in cognitive stages, illustrating the cognitive aspect of moral development and the belief that children were active participants in their moral development (see Chapter 6 for further detail). These ideas were also developed further by Kohlberg (1976).

Lev Vygotsky (1896–1934) was a Russian teacher, psychologist and philosopher (see Picture 1.5). He initially studied law but became increasingly interested in how his pupils learned and, as a result, turned to research in developmental psychology in 1917, following

Picture 1.5 Lev Vygotsky
Source: Sovfoto/Getty Images

the Russian Revolution. Developmental psychology became his lifelong passion and since the 1960s, when his writing was translated into English, his work has greatly influenced thinking in the UK and other Western countries. His ideas have had a great impact on educational developments in a number of areas:

- Vygotsky believed that the child's social and cultural environment affected cognitive development and that learning occurred through the interaction of skilled adults (Vygotsky and Cole, 1978) and through social interaction with peers;
- he identified the **zone of proximal development** (ZPD), or the difference between tested levels of cognitive development and potential development that can be achieved through interaction with adults;
- he analysed children's play and concluded that it was important not just for emotional and physical development, but also for cognitive development;
- Vygotsky (1962) believed there was a strong interrelationship between language and thought and that speech was a tool developed in a social context which becomes a vehicle for thought;
- he also explored the transferability of higher order skills and of thinking processes from one context to another, concluding that some higher order thinking skills, such as classification and logical thought, were transferable.

Erik Erikson (1902–1994) was particularly interested in the development of identity, an interest which arose out of his personal concerns about identity. He was born in Frankfurt, Germany, and his father was an unnamed Danish man whom Erikson never met. His mother, who was Jewish, later married his paediatrician and Erikson appeared to suffer an identity crisis, changing his name (from Homburger to Erikson), citizenship (from German to American) and profession (from artist and teacher to psychoanalyst). He was greatly influenced by the work of Freud, having met psychoanalyst Anna Freud in Vienna, and developed Sigmund Freud's psychosexual theory into a psychosocial theory, which recognised the lifelong nature of emotional, moral and personality development. Erikson's first book (1950) became a classic in the field of psychosocial study. He identified the importance of a loving and emotionally stable home life, and the influence that culture and society had on a child's development. He also identified how conflict resolutions can be supported by carers. Despite the interest in Erikson's ideas, psychosocial theories are less popular today than behaviourist theories (for example, Skinner, 1953; Bandura, 1977; and see Chapter 7).

Burrhus Skinner (1904–1990) developed a **behaviourist** theory of development, from the thinking of John Locke (1632–1704) and John Watson (1878–1958). Behaviourist theories work from the premise that the child is a tabula rasa, or blank sheet, which social interaction writes upon or develops; in other words, children develop through imitation, reinforcement and punishment. Skinner's theory of operant **conditioning** (1953) was developed after studying rats. Operant conditioning identifies that reward results in learned behaviour, and provides an alternative to Pavlov's classical conditioning (1927), where a

stimulus-response results in automatic behaviour. Skinner's theory has been successfully applied to human behaviour and forms the basis of many behaviour management theories in families and education, initially through the use of reward and punishment and more recently through positive reinforcement methods. The behaviourist theories have continued to be developed through the work of Bandura (1977).

Reflective Tasks

Reward or punishment

Level 1

Identify an example from your own experience which involved either reward or punishment.

- How did the experience affect your subsequent behaviour?
- Do you feel reward is more effective than punishment? Identify the reasoning behind your decision.

Level 2

Identify an example in your own practice where you use reward or punishment with children to influence behaviour.

- How successful is the strategy of using these?
- Do you use reward more than punishment? Identify why.

Level 3

Identify an example of both classical (Pavlov, 1927) and operant (Skinner, 1953) conditioning from your own experience or practice in your setting. Why do you think that operant conditioning is easier to identify in practice than classical conditioning?

John Bowlby (1907–1990) studied medicine before moving into developmental psychology through psychiatry and psychoanalysis. While working voluntarily at a school for children with psychological problems, he became intrigued by the behaviour of two children who showed signs of emotional problems; one, a teenager, being rather insular and remote, without a stable mother figure, and the other being an anxious, younger child who followed Bowlby around. As a result of these experiences, Bowlby began to consider

the effects of early experiences on subsequent development and became convinced of the importance of the parental relationship in early life. Between 1958 and 1960 he published three papers on the theory of **attachment** in babies and young children (Bowlby, 1958; 1960a; 1960b). Bowlby identified the early bonding that occurs in babies is similar to Lorenz's imprinting in chicks (1952). There have been a number of criticisms of Bowlby's research, mainly because it focused primarily on children with emotional problems and the effects of parental deprivation (see Chapter 6 for further detail). There is also concern that Bowlby's research has been misrepresented to encourage post-war mothers to stay at home, thus reducing male unemployment, indicating a possible early political spin of the type more associated with modern society and politics.

Further research into attachment theories has been carried out by Ainsworth and her colleagues (1978), who measured the strength of attachment in young children and identified four different types:

- secure attachment;
- avoidance attachment;
- resistant attachment;
- disorientated attachment.

The debate on care in the home versus group based childcare is one that is continually pertinent and challenges objectivity.

Reflective Tasks

Care at home

Level 1

Decide whether you feel that pre-school children are best cared for at home.

- How do you think your feelings are influenced by your own childhood experiences?
- How do you feel children benefit from group based childcare?

Level 2

- Are there aspects of a child's early development which can be more effectively supported at home rather than in a formal setting?
- Why do you think this?

- Can you support your views with evidence from your own experiences and practice?
- Do you think you are able to be objective in this debate?

Level 3

Identify those aspects of development which are best supported at home and those best supported in your setting. Identify the evidence from your own practice which has influenced your decisions.

- Could the evidence also support alternative viewpoints?
- What do the reflections mean for your own setting?

Abraham Maslow (1908–1970) was born in Brooklyn, New York, in 1908, the first of seven children born to uneducated Jewish immigrants from Russia. He studied law, but did not excel in his studies until he moved into the study of psychology at the University of Wisconsin. Here he worked with the animal psychologist Harry Harlow, who was researching attachment behaviour in rhesus monkeys, and later with Edward Thorndike (who was also a psychologist working in the area of animal behaviour), where he became interested in human sexuality. His work with monkeys and humans led him to consider social, physiological and emotional needs and he identified a hierarchy of basic needs which links the three areas (Maslow, 1968). In his hierarchy, each level needs to be fully met in order for development at the next level to take place (see Figure 1.1; see Chapters 3, 6 and 7 for further consideration). Maslow believed that physiological needs are at the base of the hierarchy and if these physiological needs are not met, then children will not be able to move up the hierarchy and concern themselves with safety needs. Safety needs lead to emotional needs and then to esteem needs. Each level has to be met in order to achieve **self-actualisation**, the pinnacle of the hierarchy. If a need is fully met, then the motivation to achieve the need is removed, but if it is not fully met there is a desire for the need to be fulfilled. Significant problems in one area of development during childhood can result in lack of full development (Maslow, 1968). In this way Maslow extended the homeostatic principle to development: that is, the tendency for the internal environment of the body to remain constant and balanced despite external conditions. However, some needs are not felt to involve balance in the same way, so that as you move up the hierarchy you may become driven to succeed, not because of a lack of success but because you have experienced success and continue to desire it. Maslow studied a few people who were highly successful and determined that full self-actualisation involves the following (Boeree, 1998):

- truth;
- goodness;
- beauty;
- unity;
- aliveness;

- uniqueness;
- perfection and necessity;
- completion;
- justice and order;
- simplicity;
- richness;
- effortlessness;
- playfulness;
- self-sufficiency;
- meaningfulness.

The importance of Maslow's ideas is in the link between the social, physiological and emotional areas of development and their combined importance on educational achievement, through self-actualisation.

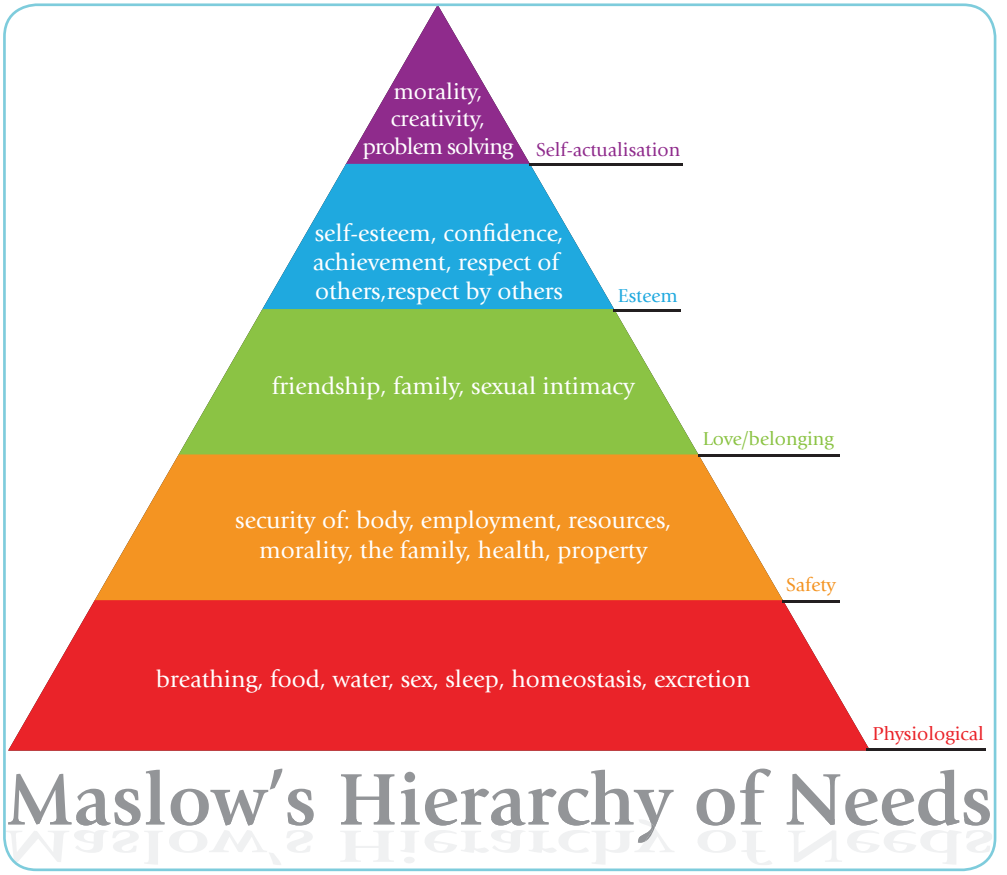


Figure 1.1 Maslow's theory of hierarchical needs
Source: YAY Media AS/Alamy Stock Vector

Bridget Plowden (1910–2000) was the daughter of an admiral who married the British peer Lord Plowden. After years of voluntary work, she became a national figure in the UK after being asked in 1963 by the then education minister, R.A. Butler, to chair the Central Advisory Council on Education, whose report, often referred to as the Plowden Report, advocated a child-centred approach, whereby 'initial curiosity, often stimulated by the environment the teacher provides, leads to questions and to a consideration of what questions it is sensible to ask and how to find the answers' (DES, 1967: 242). The report had enormous influence on education in the 1960s and 1970s, leading to a more child-centred approach to education which has subsequently influenced early education not only nationally (DfES, 2007) but also internationally. Through the report, Plowden identified her belief in:

- play;
- discovery learning;
- parental partnership in early education;
- the idea of 'learning readiness'.

These ideas were incorporated into early years education, although they went out of fashion during the 1990s. For example, discovery learning became synonymous with children playing without purpose or learning objectives or support. In this view of discovery learning, children were thought to have no preconceived or existing conceptual ideas and they learned through unstructured, exploratory approaches. In the 1990s, after the introduction of the National Curriculum (DfEE, 1999a) and strategies for learning (DfEE, 1998; 1999b), there was a more structured approach to learning. We now realise that teaching and learning involves building on existing ideas, but also motivating young people. In current early years settings, discovery is encouraged (DfE, 2014) and advocated through emphasis on creativity (see, for example, Wilson, 2014) and play (Moyles, 2015). While learning in older children is often hampered through the lack of real discovery, some contexts are beginning to reintroduce more discovery play.

Study Skills Tasks

Selecting and using literature

Level 1

Find a current book which advocates play for effective development. Compare the ideas with those of the theorists and reformers who have advocated play (Froebel, Steiner, Vygotsky or Plowden).

Level 2

Read the part of the Plowden Report (DES, 1967) which describes discovery play and compare with Moyles's (2015) ideas.

Level 3

Read what Froebel (1826) and Plowden (DES, 1967) have to say about play and compare with the views of two modern writers.

Jerome Bruner (1915–2016) was an American who played a major part in developing thinking in cognitive psychology. He identifies three modes of representation, or cognitive actions, which enable the mind to make meaning. The first is 'enactive representation', whereby cognition is expressed through physical actions; the second is 'iconic representation', whereby objects and events experienced through the senses are represented by mental images; and the third is 'symbolic representation', whereby thought is expressed through symbols, such as language. Bruner believed that cognitive development involves the ability to categorise the different representations and so build more complex mental images. During the 1970s, Bruner began to explore the role of language in cognition and the importance of cultural and language interaction on development, recognising the role of adults in scaffolding learning through skilled interaction. While this idea is not new (see, for example, Vygotsky, earlier on in this chapter), Bruner's influence on early education in the latter part of the twentieth century is clear. His theory of constructivism (see Chapter 4) identifies that children develop cognitively through experience and interaction, actively constructing meaning as a result, and supported discovery learning as advocated by the Plowden Report (DES, 1967).

Urie Bronfenbrenner (1917–2005) was born in Russia in 1917 and went to live in the USA at the age of 6. He graduated in developmental psychology and continued his research in the area, putting forward theories and providing advice on the implications and applications of his theories. His ecological systems theory (Bronfenbrenner, 1995; Bronfenbrenner and Evans, 2000) views the child as developing within a complex social system, affected by relationships and the surrounding environments (see Figure 7.2). These environments extend beyond home, school and the local community, as follows:

- *Microsystem*. This is the closest system to the individual child and involves the child's immediate surroundings: their immediate family, their immediate carers and the community in which they live and play. The microsystem influences the child's behaviour, although not their innate characteristics (physical attributes, personality, abilities). Within this system, children who display positive characteristics are likely to have these positively reinforced. Adults who have positive relationships within this environment will also positively reinforce behaviours in children.
- *Mesosystem*. This system is once removed from the individual child and involves interactions between the child's microsystem: home, school, childcare and family, which affect the child's social and psychological development. For example, parental involvement in childcare and education affects long-term cognitive development, and parents who interact with other parents in childcare or mother and toddler groups are likely to develop their parenting skills.
- *Exosystem*. This system is removed from the child, in that they are not directly involved with the interactions in the system and it does not directly influence children socially or psychologically. It involves both informal support for the child, such as the extended

family (grandparents, aunts, uncles), friends, neighbours, workplace, church and community ties, as well as more formal support, such as community and welfare services.

- *Macrosystem*. This is the system furthest removed from the individual child and involves the cultural values, laws, customs and resources which affect the support children receive in the microsystem. For example, in societies where there is high quality childcare and benefits for working parents, the children benefit in their everyday lives.

Loris Malaguzzi (1920–1994) helped to found a system of pre-school education in Reggio Emilia, a small wealthy city in the Emilia Romagna region of northern Italy. The context for the Reggio Emilia system of pre-school education was that after the Second World War, working parents in Italy wanted new schools for their children which would develop the thinking and social skills necessary for a new democratic society. In 1963, Reggio Emilia opened its first school and, through the work of Malaguzzi, disseminated its philosophy both nationally and internationally (see Picture 1.6). Malaguzzi believed that creativity is a characteristic way of thinking and responding to the world and wanted to change the culture of childhood, through debate on the rights and potentials of young children in our changing society. Fundamental to this debate is the Reggio Emilia image of the child, who is competent, active and critical, and is able to develop relationships, construct meanings and decode symbols and codes (Rinaldi, 2006). The Reggio Emilia philosophy is based on partnership enquiry involving all concerned with the development of the young child and leading to effective home–school partnerships and relationships (Thornton and Brunton, 2005). As well as home–school liaison and the democratic rights of children, the principles of the Reggio Emilia early childhood approach include (Edwards *et al.*, 1993):

- the environment as a teacher;
- children's multiple symbolic languages;
- the teacher as a researcher;
- long-term projects.

Picture 1.6 Reggio Emilia
Source: Ainara Garcia Azpiazu/Getty Images

Albert Bandura (1925–) is a Canadian psychologist who became very interested in behaviour theories and studied aggression in adolescence. In applying the behaviourist theory to his work on aggression, Bandura felt that the idea that it is the environment that causes behaviour was too simplistic and he suggested that behaviour, in turn, can cause the environment. This is known as reciprocal determinism. In his social learning theory (Bandura, 1986), personality results from an interaction between the environment, behaviour and psychological processes, and as such Bandura moved away from the strict behaviourist theories as described above (see Skinner on p. 33) and recognised the role of cognition in behaviour. Through his observation of children and his famous research using the Bobo doll, Bandura identified the role of imitation, modelling and self-regulation on behaviour (Bandura, 1977). In this study an inflatable doll, shown in a video, was seen by children to be hit aggressively; then, when allowed to play with the doll, the children imitated the aggressive behaviour they had witnessed, without rewards or punishments to reinforce behaviour. Bandura undertook a variety of different studies using the Bobo doll and established that the modelling process required the learner to:

- be attentive;
- retain the image: that is, to remember the behaviour;
- reproduce the behaviour;
- be motivated and wish to imitate the behaviour. This motivation could be because the behaviour has been reinforced through punishment or reward in the past, or because there are future incentives expected, or because the behaviour has been seen to be reinforced with others.

Another aspect of Bandura's social learning theory is the idea of self-regulation, or control of our own behaviour. Self-regulation occurs in three stages: self-observation, self-judgement and self-response (treating yourself if you succeed or punishing yourself if you do not). In this way, Bandura began to move into emotional aspects of learning, identifying certain unhealthy personality traits which can lead to self-punishment, aggression, depression and escapism. Bandura's ideas have led to the current belief in the importance of adults as good role models for behaviour and the concerns that famous role models should demonstrate exemplary behaviours. Many current educational practices apply both imitative and self-regulatory practices. For example, teachers will read books during quiet reading time, to encourage children to read. Some early years practices, such as Reggio Emilia and High/Scope, are based on aspects of self-regulation, with children making decisions for themselves and evaluating the success of their work.

Lawrence Kohlberg (1927–1987) was an American who started out as a developmental psychologist, studying under Piaget and then moving into the study of moral education, developing a cognitive theory of moral development. Like Piaget he used stories to investigate the way children develop moral reasoning. Kohlberg's theory of moral development (1976) identified three levels and six stages of moral reasoning (see Chapter 6):

- Level 1: Pre-conventional morality;
- Level 2: Conventional morality;
- Level 3: Post-conventional morality.

Kohlberg believed that moral development could be facilitated through discussion, argumentation and social interaction, enabling movement through the stages, although many adults are thought never to reach Kohlberg's final stage. The development of personal, social and health education (PSHE) and citizenship in the school curriculum can be argued to be based on Kohlberg's ideas for moral development through social interaction.

David Weikart (1931–2003) was an American psychologist who, in 1962, developed a coordinated set of ideas and practices in early childhood education based on Piaget's theories of development. This became known as the High/Scope Cognitively Orientated Curriculum, which is a curriculum underpinned by the belief that children are active learners who learn best from activities planned and executed by themselves (Hohmann and Weikart, 2002). The curriculum was designed for 3- and 4-year-old children in Michigan, USA, to combat the negative effects of poverty. Weikart became head of the High/Scope Educational Foundation in the 1960s and 1970s. In the High/Scope curriculum, children and practitioners work together to support child autonomy and independence, with children planning their activities before carrying them out and then reviewing them afterwards, in a child-centred reflective cycle of plan–do–review. The central principles of the High/Scope pre-school curriculum include the following (Hohmann and Weikart, 2002):

- children are active learners, creating their own meanings from their experiences;
- active learning is dependent on quality adult–child interactions;
- the learning environment needs to be well planned and well laid out to support development;
- daily routine is an essential element of active learning;
- assessment is a fundamental daily aspect of learning.

Many of these principles are not new and can be found in the theories of Froebel (active learning), Vygotsky (adult–child interaction), Steiner (daily routines), and reforms instigated by Plowden (active learning) and Reggio Emilia (learning environment). The difference is the complete package of ideas and the way in which they are put into practice.

The High/Scope Educational Foundation has also carried out considerable research into the effects of the programme on short- and long-term development, which seems to indicate that spending on early years is an investment. Through a longitudinal study, High/Scope has shown that high quality, cognitively oriented nursery education, with adult-guided play and good home–school liaison, enables children to achieve better than their peers through school and function better in society as adults (Schwienhart *et al.*, 1993). The High/Scope approach has been influential in the development of Early Intervention programmes in the UK, which you can read about later in this chapter.

Reflective Tasks

Theorist, reformer, implementer or consolidator

Level 1

Consider the difference between a theorist, reformer, implementer or consolidator.

Level 2

Write a definition for a theorist, reformer, implementer and consolidator.

Level 3

Using your knowledge of the individuals, fill in Table 1.2:

1. by deciding who is a theorist/philosopher, reformer, implementer or consolidator;
2. by considering whether they were concerned about the educational (intellectual), social, health (physical) or emotional welfare of the child.

See the Glossary for definitions.

Table 1.2 Theorist, reformer, implementer or consolidator? What was the contribution of these individuals to early childhood understanding and practice?

Name	Theorist/ Reformer/ Implementer/ Consolidator	Educational (intellectual)	Social	Health (physical)	Emotional

New and emerging theories

There are a number of new and emerging ideas which are influencing education, care and provision in the early years. This chapter will continue by looking at a few of these and then conclude with some recent research evidence which is informing current early years practitioners.

In recent years there has been a great deal written about creativity and it is emphasised in the Early Years Foundation Stage curriculum, EYFS (DfE, 2014), and the National Curriculum (DfE, 2015). The EYFS was envisaged as a play-based and creative curriculum for providers and practitioners, while the National Curriculum has a slightly different emphasis, as seen in the following introduction provided by the Department for Education in 2015 (DfE, 2015: 3.1: 6).

> The national curriculum provides pupils with an introduction to the essential knowledge that they need to be educated citizens. It introduces pupils to the best that has been thought and said; and helps engender an appreciation of human creativity and achievement.

One problem with the idea of creativity is that there is no one definition; different individuals or groups assign different meanings to it and it can often mean different things in different contexts (for example, in the arts, sciences and technologies).

Creativity is no longer considered to be exclusively the preserve of the arts (Prentice, 2000), but rather to incorporate aspects of problem-solving (de Bono, 1992) and making connections (Duffy, 1998), and is considered to be multifaceted (Beetlestone, 1998). Its inclusion in education (DfE, 2015) is based on the belief that it is a potential in all children, which can be developed with support and encouragement (Craft, 2002; Wilson, 2014). However, creative children require creative practitioners. These practitioners are ones who make connections between aspects of learning across the curriculum, providing original and creative experiences in order to develop children in cross-curricular ways. They are knowledgeable, competent and independent, being able to make learning decisions, extending or adapting ideas and producing novel ideas for achieving objectives, and as a result the children's learning will be enhanced. According to Cremin (2013: 42), the creative practitioner is:

> One who is aware of, and values, the human attribute of creativity in themselves and seeks to promote it in others.

This is a perspective endorsed in recent research by Ofsted, entitled 'Teaching and play in the early years – a balancing act?' (2015: 10–14), which identified the following in relation to the practitioner in successful settings:

- communicating and modelling language;
- showing, explaining, demonstrating, exploring ideas, facilitating, encouraging, questioning, recalling and providing a narrative for what they (children) are doing;
- setting challenges;

- attention to the physical environment and the equipment provided;
- structure and routines of the day that establish expectations.

It is clear that these approaches mirror aspects of the theories and ideas outlined previously in this chapter – you will be able to explore these further in the task outlined below.

Study Skills Tasks

Selecting and using literature

Find some books on early years reformers and theorists and add their names to Table 1.2.

Level 1

Using the information from the books, decide which of these reformers and theorists have influenced:

- early years social care;
- early years education;
- early years health care.

Level 2

Choose one reformer or theorist you have added to Table 1.2 and find out about them from three different books. Compare the information in the books and see if they are saying the same things about their beliefs.

Level 3

Choose one reformer or theorist you have added to Table 1.2 and find out about their lives from at least three different sources. You can use books, journals and web-based sources.

Learning theories are very popular and form the basis of much discussion in education, with practitioners attempting to adapt experiences for different sorts of learners. These theories often divide learners into three groups, those who favour visual methods, those favouring auditory methods and those favouring **kinaesthetic** methods (Dryden and Vos, 1999), although some (Johnston, 1996) identify four ways in which learners process information (see Chapter 4) and others multiple abilities or intelligences (Gardner, 1983). There does not appear to be any consensus on what learning theory is and there is a great concern that it is being advocated without firm research evidence of its worth (Coffield *et al.*, 2004). VAK theories (for visual, auditory, kinaesthetic) identify that, although much early years provision is active, educational settings tend increasingly to favour the visual and auditory learners as children start school and move up the key stages. However, there is little common

understanding of what is meant by kinaesthetic learning and how it differs in younger and older learners. Although popular, these theories do not appear to have a theoretical basis in research (Revell, 2005), with most research being practitioner-based and specific, with no conclusive evidence. Indeed, Gardner's theory of multiple intelligences (1983) has been adapted and used in many educational settings, although it was not intended to be used in this way (Revell, 2005). There is considerable popular support for these theories and evidence from practice to support them, but until the theories have a thorough research base and lead to real understanding of learning theories in practice, we need to take great care in using and adapting them.

There are a number of cognitive theories which are having an impact in practice. **Cognitive acceleration** is another very popular theory, but, like learning theories, it is not convincingly evidence-based and there is no common agreement about what it is. In some views it involves the process of supporting cognition by removing artificial obstacles to the development of gifted and talented children. **Constructivist** theories have developed from Piaget's and Vygotsky's cognitive theories and involve the child in constructing their own meaning, including alternative conceptions, from experiences and learning. These are acknowledged as occurring in many areas of learning (Littledyke and Huxford, 1998) and there is a huge body of research evidence in some areas (Johnston, 2005). Constructivist theories view learning as a continuous process, whereby children construct links with their prior knowledge, generating new ideas, and checking and restructuring old ideas or hypotheses, which is therefore very active. Such theories have been increasingly influencing changes in thinking in recent years, although changes in practice have been much less evident, possibly because of the difficulty in implementing real and sustained changes in practice. These ideas will be discussed more fully in Chapter 4.

Early years childcare settings are developing in a multidisciplinary way, with care focusing on the social development and health of children, as well as education. With the introduction of Sure Start in the late 1990s, extended schools and wrap-around care were introduced. This led to settings providing breakfast, after-school care, educational (nurseries, speech therapy) and social services and health facilities on one site. This focus on holistic care and development was incorporated into the government policy Every Child Matters (DfES, 2003), which identified five outcomes for every child:

- to be healthy;
- to stay safe;
- to enjoy and achieve;
- to make a positive contribution;
- to achieve economic well-being.

These initiatives, together with improved training for practitioners, have had an impact on the early years sector as the focus shifted towards the social development and health of children as well as education. Early Intervention programmes specifically seek to advantage children who are at risk of low educational achievements (Evangelou *et al.*, 2005) and rely heavily on neuroscience (brain science) to explain and support the policy and practice. Neuroscience asserts the formative importance of attentive parenting (mothering, in particular) for babies' brain development and the narrow window available for preventive intervention (Edwards *et al.*, 2015). These ideas have been popularised in a number of texts read by

practitioners, for example, the book written by Sue Gerhardt in 2004, entitled *Why Love Matters: How Affection Shapes a Baby's Brain*, and the American writer Rima Shore's book entitled *Rethinking the Brain: New Insights Into Early Development*. Edwards *et al.* (2015) have noted that this interest in brain science as the evidence base for early years policy has been used to justify a change from universal support services for parents towards funding of national and local intervention services targeted at disadvantaged communities and families around the 'crucial ante natal and post natal period of 1001 days' (Edwards *et al.*, 2015: 3).

Research

Early years and childcare provision

The importance of play has been a recurring theme in early childhood theories; it has been discussed throughout this chapter and its importance will continue to be a theme and thread throughout this book. However, provision for the early years has changed considerably since the first edition of this book was published in 2008, with a greater emphasis being placed on group day care provision, provided mainly by private nurseries, and the introduction of the Early Years Foundation Stage curriculum for 0–5 years of age. This growing focus on structured learning rather than learning through play is a concern for early years practitioners and childcare providers. Successive UK government policies have introduced universal provision for under-5s, increased the number of hours of funded entitlement for children under 5 and progressively reduced the age at which children become entitled to funded early years provision (DfE, 2015). This has led to a debate around access to nursery places, sufficiency, cost and quality. Most recently there has been an expansion of early years provision being based in schools, including care for 2-year-olds (PACEY, 2015).

Research has shown that good quality early years education can have a positive effect on the educational, cognitive, behavioural and social outcomes of children, both in the short and long term. Some of this research has been longitudinal, studying the long-term effects of childcare provision on development. For example:

- The EPPE (Effective Provision of Pre-school Education) project, a five-year study of the attainment and development of children aged between 3 and 7, was able to identify the most effective pre-schools that produced the most developmental benefit for children (Melhuish, 2015).
- A follow-up study, EPPSE, the Effective Pre-school, Primary and Secondary Education project, addressed the longer-term effect of Early Childhood Education and Care (ECEC), and the results have been summarised (Sylva *et al*., 2010).
- The research into the effects of the High/Scope pre-school programme (Schwienhart *et al*., 1993), a longitudinal study of children from pre-school and into adulthood, has been influential in the development of early intervention strategies which seek to advantage children who are at risk of low educational achievements (Evangelou *et al.*, 2005). Good outcomes are also linked to adult–child interactions that challenge

children and extend thinking through open-ended questioning. The work of Kathy Sylva *et al.* (2010), for example, draws on developmental theory to measure quality in learning environments and the interaction between adults and children utilising a structured measurement tool known as ECERS, which stands for Early Childhood Environment Rating Scheme.

- Early Intervention programmes – for example, the Sure Start programme introduced by the Labour government as part of a National Childcare Strategy in the 1990s – have been evaluated and compiled into reports referred to as NESS (National Evaluation of Sure Start) and were compiled by the academic Edward Melhuish in 2005, 2010 and 2011 (Melhuish, 2015: 29–49). The findings were disappointing as they demonstrated that early improvements in child outcomes were not maintained. Subsequent economic recession and government changes have led to changes in the funding of what is now referred to as Sure Start Children's Centres, whose core purpose now is to improve outcomes for young children and their families and reduce inequalities between families in the greatest need. The emphasis is on child development and school readiness, parenting aspirations and parenting skills, and child and family health and life chances. The report outlining these changes can be viewed on the website of the charity 4Children (www.4children.org.uk).
- The research supporting the concept of 1001 days as a critical period was published by an All Parliamentary Group in 2014 and was entitled *The 1001 Critical Days: The Importance of the Conception to Age Two Period* (HM Government, 2014).

Study Skills Tasks

Selecting and using literature

Find some current research into one of the areas of early childhood:

- early years social care;
- early years education;
- early years health care.

Level 1

- What are the main findings of the research?
- How does the research impact on early years provision?

Level 2

- What do you feel about these findings?
- How will this research change your beliefs and practice?

Level 3

- How does this research impact on your setting?
- What changes will you make in your provision as a result of this research? Why?

Summary

- Some of the earliest pioneers are from the eighteenth and nineteenth centuries. They include Jean-Jacques Rousseau (1712–1778), Johann Heinrich Pestalozzi (1746–1827), Jean Frederic Oberlin (1740–1826) and Friedrich Froebel (1782–1852).
- A common theme of these pioneers, particularly Rousseau, Pestalozzi and Froebel, stressed the individuality of the child and the importance of experiential learning. Oberlin believed in the importance of speaking and listening within a varied and balanced curriculum, noting the importance of the adult as role model. All influenced practice in early years education.
- John Dewey (1859–1952) was particularly influential in educational philosophy. He believed in child-centred education and opposed authoritarian methods of education, feeling that children should make decisions and choices to prepare for a democratic life.
- Philosophers whose beliefs have influenced education to such an extent that their names are used as a label to indicate that their philosophy permeates the school's approach include Maria Montessori (1870–1952) and Rudolf Steiner (1861–1925). Two of the principles of the Montessori Method are that early childhood should be child-centred but not child-led, and that children determine their own rate of progression. Steiner's philosophy advocates the importance of spiritual growth and holistic education.
- Other key influences in education are Loris Malaguzzi (1920–1994), whose pre-schools in Reggio Emilia have international influence with the 'Reggio Emilia' philosophy; David Weikart (1931–2003), who is associated with the High/Scope approach; and Bridget Plowden (1910–2000), whose report had enormous influence on education in the 1960s and 1970s, leading to a more child-centred approach to education, which subsequently influenced early education not only nationally but also internationally. In the early 1990s many of Plowden's ideas went out of fashion.
- Rachel McMillan (1859–1917) and her sister Margaret (1860–1931) were both committed to social welfare and reform of provision for young children. Margaret McMillan opened nursery schools with children's health and care as priorities. They opened the first 'open-air' nursery.
- Influential developmental psychologists include John Bowlby (1907–1990) with his theory on attachment; Urie Bronfenbrenner (1917–2005), whose ecological systems theory views the child as developing within a complex social system, affected by relationships and the surrounding environments; and Lawrence Kohlberg (1927–1987), who developed a theory of moral development.

- Influential cognitive psychologists include Jean Piaget (1896–1980), who, through studies of his own children, identified four stages of cognitive development; Vygotsky (1896–1934), who identified the zone of proximal development (ZPD); and Jerome Bruner (1915–2016) with his theory of constructivism. All three of these psychologists have been highly influential in developing our understanding of how children learn.
- Behaviourist theories have been developed by Burrhus Skinner (1904–1990) with his theory of operant conditioning, and Albert Bandura (1925–) with his social learning theory.
- Other psychological theorists include: Freud (1856–1939) and his theories on the development of personality and psychosexual development; Erik Erikson (1902–1994) and his psychosocial study on identity; and Abraham Maslow (1908–1970) with his hierarchy of basic needs.
- There are differences between a philosopher, a reformer, an implementer and a **consolidator**.
- The pioneers discussed were concerned with one or more of these aspects of development: educational (intellectual), social, health (physical) and emotional welfare of the child.
- New and emerging theories and developments include issues around creative development; learning theories and questionable adaptations of Gardner's multiple intelligences; brain development; development of multidisciplinary settings, incorporating social care, health and education; and tensions between government policy and practice.

Key Questions

- Who are the influential early pioneers and reformers that have historically influenced practice and provision in the early years?
- What are the key events in their lives that have influenced them and helped to formulate their beliefs?
- What are the main features of each of the theories/beliefs held by the early pioneers and reformers?
- How have these beliefs influenced current practice and policy in early childhood education and care?
- Who and what are the recent, new and emerging theorists and theories emphasising the current issues in Early Childhood Studies, both nationally and internationally?

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1

THE IDEA OF EVOLUTION

THE ODDEST THING IS that you're not quite the same person as you were a few seconds ago. You have a memory of picking up this book, and this memory has joined others held somewhere in your biology: how you came to be here today, who you are and even how to read these words.

Something must change amongst the atoms and molecules of your body for you to learn and remember these things. Learning, in other words, is transformative in a very concrete sense – it changes not just our mental world but also our biological form. Learning often accumulates so gradually and quietly that the changes go unnoticed. But some ideas are so profound they entirely alter a person's view of themselves and what's around them. And when that idea spreads, it can transform others until the world itself seems changed.

On 15 September 1834, the seeds of one such idea were waiting to be discovered – perhaps the biggest scientific idea of all. The theory of evolution would help us understand how the diverse abilities of species came about, including our transformative ability to learn. On this day, by a small volcanic island 200 miles off the coast of Ecuador, a rowing boat was launched from the HMS Beagle. Its occupants negotiated it along a treacherous and abrasive coastline. Eventually, the crew found a patch of black sand where their craft could avoid being scuppered. A young Charles Darwin stepped out onto San Cristobal Island, one of the *Encantada*, or enchanted isles (aka "The Galapagos"). These islands had been a foggy sanctuary for pirates raiding Spanish galleons and Darwin was also a treasure seeker – of a type. He was hunting specimens of local animals, but this island did not look promising. In his diary he wrote: "Nothing could be less inviting than the first appearance". He didn't know it then, but the treasures he was

about to discover would play a critical role in solving the "mystery of mysteries": how life evolves, and how one species can become another.

The observations and specimens that Darwin amassed would help him launch the most influential and important theory of our time. And yet, Darwin was not a qualified scientist. Like many young men of his age, he had been pursuing leisure interests while postponing a "proper job", and he was especially fond of collecting beetles and bugs. He had dropped out of medical school and been pushed into clerical training in Cambridge in readiness for the Church – then the last resort for hopeless young men from good homes. His suitability for the Church was tainted by a dwindling faith and little interest in his studies but the consolation would be a rural parish with the time and opportunity to pursue his collecting. Fate, however, had something else in store. Cambridge led to regular contact and then friendship with a Botany professor called Henslow, with whom Darwin enjoyed many long rambles and collecting expeditions in the surrounding countryside. When Henslow turned down a trip on a survey ship called the Beagle, he suggested Darwin should go. Its captain, Fitzroy, mindful of his predecessor becoming severely depressed and shooting himself, was keen to find company for the two-year voyage ahead. The captain needed someone to eat with, someone who could engage in interesting conversation and keep his demons in check. A naturalist with the skills to collect some interesting specimens would, of course, be a bonus.

In 1836, after five years, Darwin arrived back from his voyage ecstatic to be once more at his father's home and amongst his sisters. Never again need he feel the seasickness that had followed him around the world. Within days, however, the family welcome had given way to a whirl of

social and scientific engagements. His letters from abroad, giving reports of strange animals, breath-taking geology and fascinating peoples, had whetted the appetites of the intellectual and chattering classes. News of his return was spreading. His celebrity status meant dinner invitations, and the opportunity to regale and entice possible funders with his South American tales. While society events rarely excited Darwin, he knew that networking would be vital for establishing himself as a scientist. He would need help from those with scientific credentials, and he would need money, to ensure he could catalogue, research and exhibit his specimens. Between the dinners he toured the institutions where he might be allowed to unpack and place parts of his collection: the Linnaean and British Museum, and the scientific societies. At the Zoological Society, he presented 80 mammals and 450 birds, on the condition that they were mounted properly and described. Amongst these were the famous Darwin finches, although at the time Darwin thought they probably all fed together as the same species, and had no sense they had adapted to different environmental niches. At the Society, the "Superintendent" John Gould quickly perceived he was in possession of a new group of finches containing 12 different species. The media was contacted and Darwin's birds were set out for display. Within a few weeks, the discovery was paraded by the President of the Geological Society at a meeting where Darwin was elected onto its council. Darwin had been slow to understand he was collecting new species but, in fairness, what counts as a new species remains a subject of debate even today (see box overleaf). Now, however, this realisation stirred an all-important question in him: why is present and past life on any one spot so closely related?

Within 18 months, Darwin was married, financially independent and living off Gower Street in the centre of London. The massive task of cataloguing, describing and publishing his specimens had really only just begun, and here he was ideally placed close to the institutions and societies that could, if he kept them sweet, support his work. But he was already pondering other, more dangerous issues, ones he had to keep from his new scientific friends for fear of alienating them. Darwin's analysis of life's diversity on the Galapagos and its island-specific variation was confronting him with more inescapable questions, such as "Why, on these tiny islands so recently emerged from the sea, were so many beings created slightly different from their South American counterparts?" In 1837, he opened a secret notebook (the "B" notebook) and began to write his thoughts on transmutation – the changing of one species into another. According to his theory, new species were constantly being generated by evolution, rather than appearing randomly or via divine design. Darwin based his arguments on three observable

Speciation and extinction

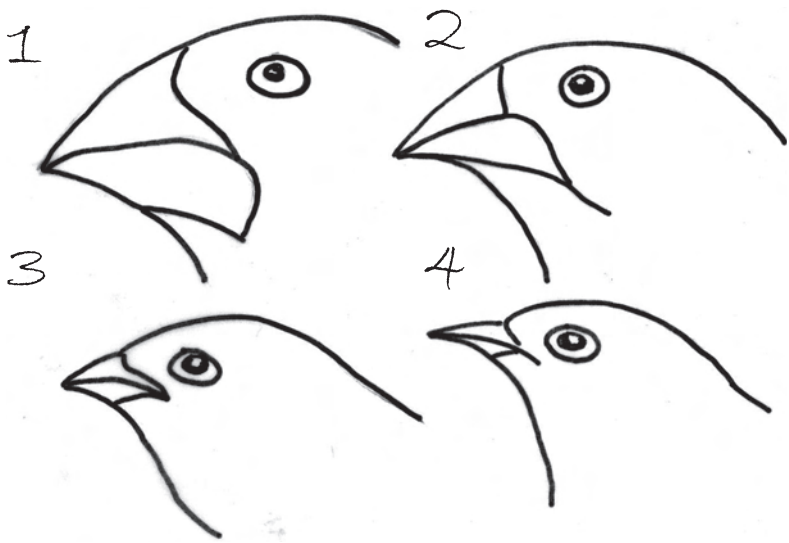
The concept of a species is a fuzzy one. When can we say there's enough difference between two evolving populations to claim we have two species? One widely used definition claims "speciation" has occurred when the two groups can no longer breed with each other.[1] Most commonly this happens when a significant number of the population becomes physically isolated due to migration or, as may have happened in the Galapagos, their habitat becomes fragmented. Within this smaller sample, inbreeding can result in a much faster rate of inherited change.

Since Darwin collected his finds on the Galapagos, small island-specific changes in its birds have been seen over just a few decades, as their environment has changed. Those birds who, simply due to random mutation, had beaks slightly more suited to the environment became naturally selected as a result.[2] Over a longer time, these changes can accumulate, explaining how different finch species have evolved and come to inhabit different islands, each adapted to the food supply offered by their island. For example, in these finches that were categorised by Gould, the beaks of 1 and 2 (opposite) are ideal for crushing large, hard seeds. While 3 has a beak ideal for grasping larger insects on the ground, 4, unlike these other finches, has the ability to catch and feed on flying insects.

When you think of the natural variation within humans, it doesn't seem so surprising that Darwin initially thought his finches were the same species. In addition to the normal variation within a species, another challenge of spotting species is that the "can only breed with each other" definition cannot apply to all life forms. It cannot, for example, apply to prokaryotes (single-celled organisms without a nucleus) since these do not reproduce sexually. These represent half the Earth's biomass and the great majority of its "species".

facts: 1) more offspring are produced than can survive; 2) trait differences between individuals influence their ability to survive and reproduce; and 3) these trait differences are heritable. On this basis, the argument follows that trait differences favouring greater fitness are more likely to be passed on, i.e. organisms evolve by a process of natural selection (see box on pp. 6–7).

But it would be another two decades before this idea was published. Why the delay? After all, you could argue the idea wasn't *that* new. In ancient Greece, philosophers had already disputed how easily and fluidly such transmutation might occur. Aristotle had suggested all living forms were variations on a defined set of fixed possibilities or "ideas". By the eighteenth century, notions of a fixed cosmic order had mostly vanished from scientific thinking about the physical world, but the living world was closer to



Compared with its beginning, defining the end of a species is much more straightforward. Almost all species known to have shared our planet are now extinct and it seems fair to assume that extinction is the fate of every species. Extinction occurs continuously but spikes have occurred in the background rate. The most dramatic on record was the Permian-Triassic extinction (252 Myr) when 96% of species disappeared. We are presently living (for the time being at least) through the Holocene extinction with rates 100–1000 times greater than background levels, with our own species implicated as the primary cause and global warming set to increase rates further.

the divine. Biology in Darwin's day still clung to notions of fixed natural types, created as part of some supernatural plan. This dominant notion of intelligent design had resisted suggestions by thinkers such as Lamarck that species might transmute. These "free-thinkers" included Darwin's grandfather Erasmus who, as a man of the Enlightenment, was contemptuous of the idea that God, rather than Nature, created the species. Erasmus was a renowned physician, lover of liberty, supporter of women's education and staunch opponent of slavery. But his family found many of his views concerning, since his unorthodoxy had gone further. Erasmus enjoyed writing erotic verse and prescribed sex for hypochondria, while his beliefs about evolution proposed "the strongest and most active animal should propagate the species, which should thence become improved". (That may explain

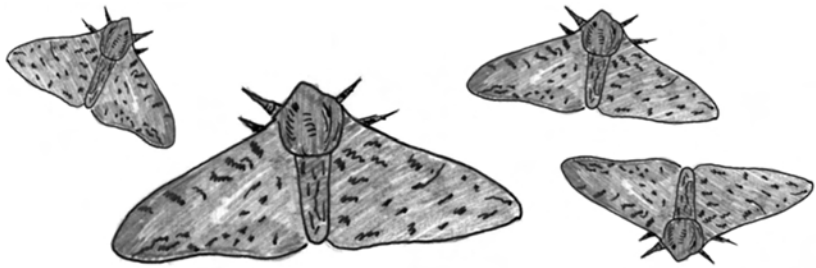
Natural selection

Though evolution tends to be slow and gradual, dramatic changes in the environment can bring about change more rapidly. The most famously observed example of Natural Selection is the pepper moth. Before 1811, only light-coloured pepper moths were known in the UK.

However, by 1848, at the end of the Industrial Revolution, a drastic increase in the dark-coloured variety was recorded around the industrial city of Manchester, where trees were often covered with soot. The Clean Air Act in the 1950s was followed by a decline in the number of dark relative to lighter-coloured pepper moths.[3]

why, in addition to the dozen children with his wives, he also had two with his children's governess.) In Darwin's family, evolutionary thinking was already associated with irreligious and immoral thoughts and behaviour – all threats to the status quo of respectable society. While Darwin remained uninterested in religion, his wife was devout in her faith and anxious about his ideas. Her anxiety worried him greatly.

Darwin knew that the damage potential for grand ideas about the origin of species extended well beyond his family. He was aware that evolutionary ideas can be exploited by both left- and right-wing politicians, much as they continue to be today. Since returning home, the gathering tumult in England was providing a lesson in the dangers. The Rev. Thomas Malthus had suggested that any population size, if unchecked, would grow exponentially and outpace the food supply. Darwin had made a similar observation in the natural world, i.e. that more offspring are produced than can normally survive. Malthus, however, made his own interpretation of this for policy – and had begun reflecting on what options should be implemented for checking population growth. He proposed not only that moral



Evolutionary theory prompted the idea that a light colour was more effective camouflage for these moths in a clean environment and a dark colour was a better way to survive predators when the environment became polluted.[4,5] Those moths whose colour was better fitted to their background survived and reproduced in greater numbers, and so that colour became predominant in the population. Understanding pepper moths from an evolutionary perspective helps us appreciate, understand and explore how they are "fitted" to their environment. It prompted further experiments that have confirmed the importance of colour for an individual moth's survival[6] and further questions about the genetics of moth colour.

restraints should be encouraged (e.g. sexual abstinence), but also that those suffering poverty and other circumstances he regarded as "defects" should not be allowed to reproduce. He promoted these policies as the available options to disease, starvation and war. On this basis, the poor did not need charity since this might expand their numbers; instead, they just needed control and discipline. Buoyed by Malthusian principles, the "New Poor Law" meant no more outdoor charity. Either the poor competed with everyone else or they would find themselves in the new workhouses that were springing up everywhere. Those outraged by inequities such as this "punishment of the poor" came together in a nation-wide protest movement (the Chartists) to support a people's charter. Riots ensued, soldiers were called out and some demonstrators were shot. One incident hemmed the Darwin family into their London home as troops charged crowds a few yards from their door.

A few days after those troop charges, in 1842, Darwin, along with his wife and children, retreated to a new and somewhat desolate home in the Kentish North Downs – far away from the chaos, unrest and noise of a

restless London. This would be where Darwin could study and develop his theory in the solitude he now loved. Gone were the sounds of the Chartist riots in the streets below, but the thought of "coming out" with his ideas was still not attractive. He was no longer the naïve young man who had boarded the Beagle to pursue his hobby and avoid a job in the Church. If not picked up by Malthusians, his ideas might be adored by revolutionaries seeking to destroy the Church's power and disrupt the class structure his family benefited from. The Church's doctrine of God-given difference was key to its authority. It justified why some might be poor and powerless and others were rich and ruling. This underpinned the religious case for keeping things broadly as they were, protecting the wealthy Church and the elite that supported it. In contrast – Darwin's theory suggested all living creatures shared the same first ancestor – that we were all part of the same web of life. It dispensed with the notion of a divine decree that separated the human from the non-human, or indeed any type of human from any other. This sense of unity and its consequent equality would be a gift to those wanting to challenge the current order, and who were now taunting the Church as a "harlot" in bed with the state. The ideas spawning in Darwin's mind were contrary to his life as a pastor's son, his yearning for a quiet country life, the strong religious sentiments of his wife and the sentiments of his own social class.

The inner conflict all this created has been linked to the many illnesses that marred Darwin's life, and blamed for the incredible delay of 20 years in publishing his theory. Yet publish he did, finally prompted into a sense of urgency when Alfred Wallace sent him an essay proposing a very similar idea. There was now no point in holding back because Wallace would publish anyway. It is fortunate for all of us that Darwin stepped into the ring at this point to promote his theory with Wallace. The ensuing debate would need his unique skills and his massive body of evidence to ensure it was taken seriously and appropriately interpreted. His scientific rigour and humanism would help illuminate evolution as a concept that unified all humanity, and all life. After his long period of covert self-examination and agonising, he finally set the date for publicly committing himself. The event was to be a joint publication with Wallace, presented at the Linnean Society in Piccadilly.

In the end, the meeting itself was something of a non-event. Darwin had recently lost his youngest child to scarlet fever and stayed at home grief-stricken; Wallace was abroad. It was the final meeting before summer recess and a small audience of about 30 members listened without comment as the secretary of the society read out the paper. The President walked out

of the meeting, lamenting how the year had been disappointing, with no "striking discoveries which at once revolutionize, so to speak, [our] department of science".

Ironically, perhaps, the lack of clamour had an encouraging effect on Darwin. He had now shown his colours and, despite all the anxiety, no-one seemed very bothered. About a year later, he published *On the Origin of Species*. Written for non-specialists, it quickly attracted comment from scientists and scholars, but also quickly ignited a mainstream interest. Darwin was amazed to hear stories about his book flying off the shelves at Waterloo Station as commuters passed through. The more popular the book became, the more difficult it was for the establishment to ignore. Passions were roused and arguments began to rage. The most famous of these debates occurred at a routine "Botany and Zoology" meeting on 30 June 1860, when a crowd of more than 700 crammed themselves into a chamber at the Oxford University Museum. With many more listening outside unable to get in, the audience watched as Bishop Samuel Wilberforce lost his argument against evolution to Darwin's friend and supporter Thomas Huxley.

Darwin on man's abilities

In the last few pages of *Origin of Species*, Darwin alluded to the significance of his theory for Homo sapiens and, most importantly, the mental abilities that many consider set us apart from the rest of the animal kingdom. Darwin suggested that knowledge of how mental abilities were prehistorically acquired (i.e. evolved) could provide fundamental insight into the nature of these abilities (i.e. our psychology):

> In the distant future I see open fields for far more important researches. Psychology will be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation. Light will be thrown on the origin of man and his history.

Note how Darwin emphasised gradualism as an important feature of this process of change. Gradualism is an enduring theme of evolutionary thinking – the idea that evolution proceeds in very small microevolutionary steps in terms of adaptations within a population. These small but observable changes can occur much more rapidly than the sort of timescales usually associated with geological time. Speciation – the arrival of a new species – is generally assumed to take longer but comes about through the accumulation of these small changes.

Generally, however, *Origin of Species* steered clear of discussing our own place in the evolutionary tale. Darwin was still stepping forward cautiously and provided no clear indication of what the light he alluded to would reveal. Addressing this question would be a challenge of the greatest sensitivity. Darwin's time was even more human-centred than our own. Holding the belief that humans were related to animals was, even leaving religion aside, commonly seen as a serious step along a slippery slope towards barbarism.

It was not long before Darwin felt forced to tackle this issue directly. Once again, he was prompted by Wallace but not, this time, because their ideas were converging. Within five years[7] of co-publishing views aligned with each other, Wallace began to get cold feet about evolution, as discussion began turning towards Homo sapiens. He started to distance himself from the notion that human abilities might have arisen through natural selection. Wallace was asking his readers, "How could 'natural selection', or survival of the fittest in the struggle for existence, at all favour the development of mental powers so entirely removed from the material necessities of savage men?" Now – with the theory of natural selection itself at stake – Darwin didn't hold back on relating evolutionary theory to Homo sapiens and society. Darwin responded to the question asked by Wallace in *The Descent of Man, and Selection in Relation to Sex*. Published in 1871, this book included discussion of evolutionary ethics and the differences between races and sexes. After drawing attention to similarities in the anatomy of humans and other animals, Darwin found intellectual similarities as well. He saw evidence of emotions in non-human animals such as curiosity, courage, affection and shame – feelings that have cultural significance in society, and also the stirrings of features considered distinctly human such as tool use, language, an appreciation of beauty and even religious inclinations. In beginning to plot a continuum between human and animal mental ability, he argued for an evolutionary basis for the arrival of our own species.

In Darwin's time, physical features could be measured but evidence for how mental abilities evolved was much more limited. Even today, there's much debate around how to compare the mental abilities of different species. Nevertheless, Darwin had made an important point: the theory of evolution could and should be applied to help understand our own brain. The leap from understanding a pepper moth's wing to human reasoning and learning may seem great, but the principle remains essentially the same. Understanding the evolutionary history of the pepper moth allows us to ask questions and learn more about how the wing colour of an existing moth "fits", or not, the

environment it finds itself in (see box on pp. 6–7). Similarly, an evolutionary perspective on the brain may allow us to ask questions and learn more about how a modern human brain interacts with its environment, including its educational environment.

Evolution gets hijacked by notions of "progress"

Only a decade after publishing *Origin*, Darwin's half-cousin Galton was already using it to argue for a science of "eugenics". In Galton's own words, this was meant "to give to the more suitable races or strains of blood a better chance of prevailing speedily over the less suitable". Galton was interested in ways to manipulate and accelerate the processes by which human evolution was progressing, improving the fitness of the species by *artificial selection*. From its outset, the very definition of eugenics was a dangerous mixture of skewed morality and misinterpretation of science. Competition, as in one line of organisms adaptively advancing in their populations over another, was an observable fact that reflected the proposed mechanisms of natural selection. However, Galton was suggesting some fixed direction of progress that could be artificially accelerated. This was not part of Darwin's theory.

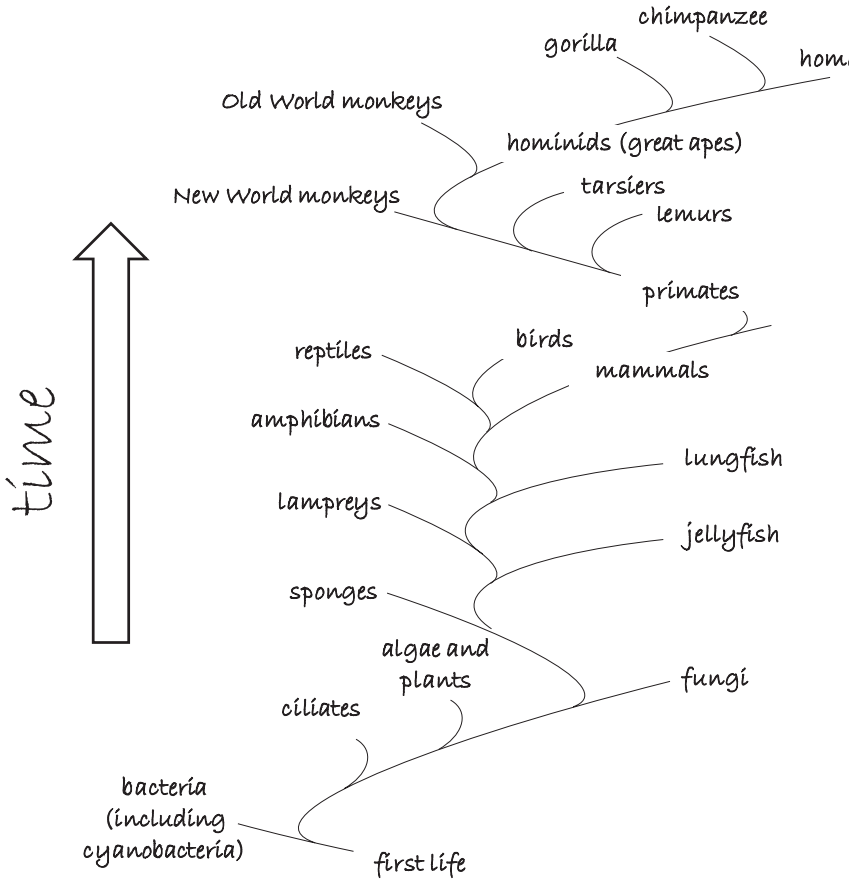
There is debate about whether Darwin believed evolution generally tended in a direction of something that could be called progress.[7] He was, after all, a man of his time, and a rosy notion of progress was central to the ethos of the British Empire. That said, Darwin's understanding of "fitness" did not lend itself well to the idea and he never associated himself with Galton's proposals. His statement in a letter to American palaeontologist Alpheus Hyatt appears to make his views clear: "After long reflection, I cannot avoid the conviction that no innate tendency to progressive development exists".[8]

Tragically, however, many influential people have been seduced by the idea that we are evolving in some identifiable direction of biological improvement, and that there is some advantage in accelerating humanity along it. At the beginning of the last century, the idea of eugenics began gathering supporters in many countries, amongst them well-respected politicians such as Winston Churchill and prominent biologists such as Charles Davenport. At first, eugenics found application in some relatively innocuous ways, such as marriage counselling. Ultimately, however, it became manifest in Hitler's programmes of extermination, justifying the pursuit of "racial hygiene".

Eugenics is dangerous because it parades a human notion of "progress" (which is defined by whoever is doing the parading) as something

biologically defined. Darwin's own diaries reveal a deep wariness of human notions of progress. During his travels, he had journeyed through lands in the New World where efficient programmes of genocide were being conducted. He found himself meeting face-to-face with characters who were linked to dubious military operations such as General Rosas in Argentina. These meetings were necessary to gain permission to cross land where indigenous peoples were being corralled into a "Christian's zoo", where the Indian women "who appear above twenty years old are massacred in cold blood". Rather than expressions of wonder at the specimens accumulating in the hold, Darwin's most powerful emotional responses were reserved for the atrocities that were occurring around him. Darwin's family strongly adhered to the belief that slavery should be abolished, but these sentiments brought him into sharp conflict with the Beagle's captain. Such experiences may have sensitised Darwin to how ideas about difference can be exploited, encouraging him to emphasise the message of life's unity he saw in evolution. Indeed, it has been suggested that political and social issues, particularly slavery, were key driving forces for Darwin pursuing evolutionary theory with such tenacity.[9] Evolution is concerned with how one form of life changes into another and so suggests, as it did to Darwin, that all life derives from a common ancestor. The idea we are all part of the same slowly shifting web of life undermines any sense of fundamental difference between races (i.e. variations) within the same species. More broadly than this, it connects all species with one another, highlighting the interrelatedness of all life (see the tree of life opposite).

Modern evolutionary theory takes care to separate evolution from cultural notions of growth and improvement,[10] and to discourage any perception of progress in one direction or another. The evolutionary meaning of the term "fitness" does not imply a score on any simple scale (i.e. speed, size, etc.), but refers to the extent to which an organism, over generations, has become suited or "fitted" to the environment. Given the environment is itself subject to constant change, it is perhaps unsurprising that evolutionary change sustained in *any* one direction over time tends to be the exception rather than the rule.[11] Natural selection has sometimes been summed up as "survival of the fittest", but in recent years scientists have come to prefer "survival of the fit enough". Evolution favours those equipped to survive, but there are few prizes (and likely some costs) for having more equipment than is strictly needed. Further limitations on any alleged scientific basis for eugenics come from our modern understanding of genetics and human ability. It seems unlikely that traits for skills such as literacy and maths could easily be artificially selected for, since the same genes, in different combinations, contribute to high and low levels of these



abilities. Nevertheless, we will see in Chapter 10 that modern science is making the idea of tinkering with human evolution much more possible.

The use of evolutionary theory to justify "scientific racism" has provided frightening examples of how science, authentic or otherwise, can be harnessed to seize moral authority when promoting ideas that are profoundly immoral. Eugenics remains a cautionary tale that reminds us of the importance of including ethical debate in the creation, interpretation and application of all science. Like many other powerful scientific ideas, evolutionary theory can be used for both good and evil, and how we use it should be informed by both science and by the views of those who might be affected. We will return to these issues again in Chapter 10.

Happily, modern evolutionary thinking has grandstanded more recently as a tool for encouraging racial tolerance rather than racial prejudice. South Africa is an example where this is particularly notable, since it was here

that eugenics once played an influential role in supporting racist sentiment and justifying apartheid. In 1996, soon after the fall of the apartheid state, Mandela's government began to replace the old racially based system of education to reflect new values and principles for the country to aspire to. In the new curriculum, students would encounter concepts of evolution and particularly human evolution, so emphasising the common origin of humankind. The origin of humans from common ancestors was now perceived, as Darwin might have wished, as a strong unifying concept useful for building, rather than dividing, a racially diverse society.[12]

Evolution and genetics – the modern synthesis

Darwin's theory was founded on the idea that traits linked to survival and reproduction success could be inherited – and this fact could be clearly observed when he wrote and published his theory. But, in Darwin's day,

DNA and the processes by which traits are inherited

DNA is a very long molecule containing genetic instructions for the development, functioning and reproduction of an organism. It consists of two strands coiled around each other to form a double helix, divided up and packaged into separate pieces called chromosomes that are stored inside the nucleus of animal and plant cells.

During the growth and repair of an organism, the DNA copies itself before the cell divides to produce another cell, allowing the new cell to have an exact copy of the DNA that was in the old cell.

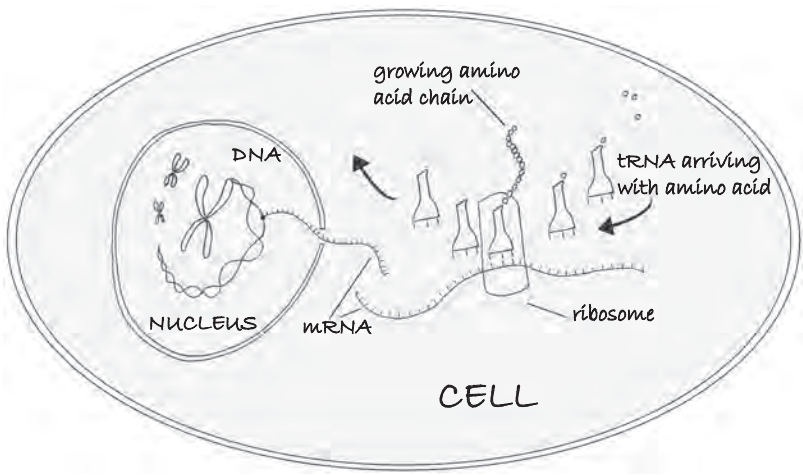
Also in the chromosome is ribonucleic acid (RNA), which helps put the DNA instructions into practice. The instructions in the DNA code for how a cell should produce proteins. Proteins do most of the work in cells and are critical for the structure, function and regulation of the body's tissues and organs, including brain tissue. Ultimately, these proteins will generate the biological structures that help create the appearance and behaviour of the whole organism. A gene is a region of our DNA that codes instructions related to a trait. The most common human traits we think about (e.g. height and intelligence) are influenced by many such regions (i.e. they are polygenic). Traits are also, to a greater or lesser extent, influenced by environmental factors (e.g. nutrition and education).

Messenger RNA (mRNA) conveys the genetic information from the DNA to where molecular machines called ribosomes link amino acids together to

no-one knew how such inheritance was happening. By 1865, Gregor Mendel published laws that showed how traits could be predictably inherited. Rediscovery of Mendel's ideas helped biologists in the 1930s to 1950s combine their observations with the new science of population genetics, creating the "modern synthesis", or "Neodarwinism". However, it was not until 1953 that the structure of deoxyribonucleic acid (DNA) and its role in storing genetic code were discovered, allowing the molecular processes of trait inheritance to finally be revealed (see box below).

By shedding light on the key process by which traits are inherited, modern genetics has supported the theory of evolution and helped us understand more about how it happens. For one thing, it seems clear that there must be sufficient genetic variation within a population for natural selection to work. This variation is essential for ensuring the presence of those with a markedly better fit, so enabling the traits associated with this fit to be selected. We now know the variation arises chiefly from the processes of

make the proteins. The amino acids are delivered by another type of RNA called transfer RNA (tRNA) but the order of linking is dictated by the mRNA, which follows the instructions it has carried from the DNA.



In sexual reproduction, DNA combines such that the offspring receive a novel mix of the DNA of their parents. This provides the genetic variation that makes evolution by natural selection possible.

genetic recombination which occur when organisms reproduce, but there are other factors contributing to this diversity too. These include processes of "mutation", in which a duplicate copy of an ancestral gene mutates and acquires a new function. This is not a very efficient source of improved fitness, because mutations appear more frequently to damage an organism than provide it with advantage. Even when competition and all else is equal, there will still be a small amount of randomness involved in how genes are transmitted across generations in a population. This "genetic drift" is another source of variation. These additional sources of variation are not adaptive in themselves: natural selection is still required for these changes to lead to improved fitness.

Natural selection is usually studied in terms of an organism surviving long enough to reproduce. However, sexual selection was also considered by Darwin as a process by which fitter traits might be selected for. Here, a mate is chosen for reproduction according to their fitness. The idea has a common-sense ring to it and feels credible, but concrete examples of sexual partners being chosen by fitness are only accumulating slowly.[13] Natural selection through being fit enough to survive, and so reproduce, remains the most widely applied theory of adaptation that improves the "fitness" of an organism, as coded in a population's genetic distribution.

Darwin, evolutionary theory and learning

There is a long history of evolution influencing educational thought. In 1881, Charles Darwin wrote a letter responding to the secretary of the Education Department of the American Social Science Association who had enquired about the significance of his theory for her area. In his letter, Darwin expresses his enthusiasm for understanding human development, and the need for research that could provide new insights. In his list of questions there is a sense that we should be concerned less with the objects of our children's attention, and more about the nature of their interaction with them. Darwin places emphasis on the importance of how the mental ability that underlies learning can be developed, rather than on the accumulation of specific knowledge and understanding. His ideas may reflect his own experience of pursuing his passion for collecting, in the face of little understanding from his father: "It may be more beneficial that a child should follow energetically some pursuit, of however trifling a nature, and thus acquire perseverance, than that he should be turned from it because of no future advantage to him".[14]

Perhaps, however, the most significant thing about Darwin's letter is that he doesn't provide specific suggestions on how we might teach and learn

more effectively. Now a respected public figure, he had already expressed a very critical view of the school system, particularly its emphasis on the classics. He believed schools should broaden their curricula to include a greater range of subjects, notably science. When considering the relationship of evolutionary theory and education, Darwin did not use the opportunity to promote a list of changes that should be made. Instead, he believed his theory could be useful in identifying educationally relevant questions on human "mental and bodily development" and that these could prompt research that could produce educational insight. He seemed to be suggesting that educational change should arise from research that evolution can help frame, not directly from evolutionary theory itself.

Today this still seems wise advice – and perhaps timelier than ever. At this stage in the twenty-first century, we are just beginning to incorporate our new understanding of brain function and development into our ideas about how we teach and learn. Evolution cannot tell us how to teach and learn, but it can help us frame and understand this research. In this way, it can help us mentally digest the significance of our biology for revising our ideas about learning and the role of learning in who we are. Just as Darwin's theory prompted questions that helped us re-evaluate the relationship between a pepper moth's wing and the tree on which it rested, so the history of the learning brain may draw attention to new ways of thinking about learners and the environments in which they learn.

As the evolutionary story of the learning brain unfolds, you will see some familiar aspects of learning arriving over deep time. In each chapter, there will be some exploration of the links between these ancient processes and our own experience of learning as modern humans. Eventually we'll arrive in the present millennium and consider how the learning brain may evolve in the future. You'll have travelled several billion years by then and your own opinions about how we acquire knowledge and understanding may have changed – will human learning look different from a deep-time perspective? But enough jumping ahead; the story is about to begin . . .