Understanding the cognitive complexities of literacy learning

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Credit: Fotalia / Tatyana Glatskih

The ability to read is a fundamental prerequisite for participation in modern information-based societies. Learning to read is a long and complex process, however, and one that not all students master with ease – as studies such as PISA have shown. Individuals with functional illiteracy can find themselves excluded from many areas of life and work. The Max Planck Research Group REaD investigates the underlying structure of students' reading skills as well as the development of these skills during childhood and adolescence. It aims to

find out how reading deficits can be addressed effectively.

Reading is a complex cognitive skill, the acquisition of which is not a matter of course. For this reason, children need educational support to successfully overcome the challenges posed by written language acquisition. Moreover, as the PISA studies have shown, all children are not equally successful in this endeavour: reading is, perhaps, the area of scholastic skills in which the biggest interindividual differences are observed and in which it is particularly difficult to implement effective training and support measures. The REaD research team at the Max Planck Institute for Human Development investigates the reasons for this.

Is reading difficult?

Why is reading so difficult? Adults often forget that reading is anything but an automatic process at first. For them it is a highly-automated skill which is used with relatively little effort. In fact, as demonstrated by the well-known Stroop effect, it is impossible for adults not to read. To demonstrate this effect, people are shown words which are printed in different colours. The task of the test subjects is to name the colours of the words as quickly as possible. The crucial factor is that some of the words presented are those used to designate colours. When the colour and meaning of a word are the same, for example when the word GREEN is printed in green, the test subjects find it easy to provide the correct answer. However, if the colour and the meaning of the word do not coincide, for example if the word GREEN is printed in red, adults find it very difficult to ignore the meaning of the word: accordingly, based on this example, they struggle to answer 'red'. Therefore, we clearly read unconsciously and automatically despite the fact that it is not necessary in this instance for naming the colours and is, indeed, an obstacle to performing the task.

This was not always the case, however. At one stage in their lives, adults also had to painstakingly work through the process of reading word by word. Sometimes this becomes clear to them when they have to read aloud in a foreign language: How do you pronounce the German word 'Schule' again? Is the 'te' at the end the French word 'petite' silent or not? And how do you spell 'spaghetti'? These are the kinds of questions that children face every day when learning to read!

What do children read?

One thing is clear: like other things in life, reading is only learned by doing it. For this reason, it is important to take a more detailed look at the information that children absorb while reading and how they use it. The German children's book corpus childLex is intended to help with this task. It provides comprehensive information about the linguistic characteristics of the language read by children. It should be noted here that the language found in books, which is known as written language, differs in various respects from the spoken language that children are very likely to have mastered before they start school. The most important difference with regard to reading is that the written language in books is far richer than our everyday language. It is a characteristic of language that the words are very unevenly distributed within it. This text is 551 words long (up to here). However, only 228 different words were used. The most frequently used word is 'the' (a total of 45 times). It is followed by 'this' (11 times) and 'and' (10 times). These are followed by 'are', 'for', 'language', 'reading', 'that' and 'word' itself (9 times). 173 words (e.g. 'book', 'French' and 'sometimes') were only used once and 26 words only occurred twice. This distribution is known as Zipf's Law in linguistics and can be roughly summarised as "a few giants and a lot of dwarfs". In other words, there are relatively few words which are used very frequently and a lot of words which are only encountered once or twice in a text.

The ratio of the number of different words to the total number of words in a text is, therefore, an indicator of the 'richness' of a text. It points to whether a text only contains familiar words or also has many new, unknown words. If different forms of linguistic communication are compared with each other, for example conversations between adults and children, television programmes and children's books, it emerges that (children's) books have a far higher lexical learning potential than other text types. Many everyday conversations ("So how was school today?") are not very complex and usually revolve around already familiar topics. When the task is to learn new things and encounter unknown words, book-reading is unavoidable. It is also clear that different types of children's books can vary considerably in this regard.

How much do children read?

Children vary not only in terms of the types of books they read but also as to whether they actually read or not. The question also arises as to how often they actually read and for how long. This is not easy to establish. Children do very little reading at school itself, at least at primary level. An average reading book for the third class (age 8-9) in German primary schools contains approximately 30,000 words – this is around the volume also contained in a volume of the 'Die Drei ???' series (German translation and adaptation of the American juvenile detective series 'The Three Investigators'). A book like 'Inkheart' (approximately 145,000 words) by renowned German children's book author Cornelia Funke contains around as many words as all of the school books used in the first to fourth primary school classes in Germany.

Therefore, it is likely that most reading takes place in situations outside of school – or not at all. Moreover, most reading episodes do not take place in an educational context, for example during school classes, but are more likely to take place outside of school and are self-controlled. When children and adolescents are surveyed about when and what they

have read outside of school in recent days, it usually emerges that they spend an average of five minutes on this activity per day. However, there are considerable differences between children here: some do not read at all and others read for hours.

A research team at the Max Planck Institute for Human Development has developed a questionnaire, which can be used to establish whether children are reluctant or avid readers. The participants are presented with a list of children's book titles and are asked to tick the books they already know. However, a series of invented book titles are included in the list (e.g. 'Ink Pain', 'Harry Potter and the Cave of Damnation') to establish whether the children are simply guessing. The results show that there are very significant differences between children when it comes to their knowledge of books.

Children differ not only with regard to how often and how long they hold a book in their hands, but also in relation to how quickly and fluently they read. The avid reader, who can be identified, for example, through reading aloud or eye movement data, develops quickly during the primary school years. When children in the second class (age 7-8) read, they need around one minute for 70 words (that is five to six sentences of average length). An adult requires only a quarter of this time for the same volume of text. In the long run, such differences add up to considerable differences: a child who reads well and for an average length of time will have read approximately two million words by the end of the sixth class (this corresponds approximately to twice the volume of words in all the Harry Potter volumes). In contrast, a child who avoids reading almost entirely and tends to have poor reading fluency will only reach ten percent of this. At the same time, a child that reads twice as much will read between four and six million words during primary school. As is the case with all exponentially growth processes, even small differences in the early stages quickly become perceptible.

It is easy to see that the above-outlined growth dynamic has considerable consequences, in relation to both the skills of pupils and the actions of parents and teachers. First, the interaction of reading behaviour and reading skill can give rise to a virtuous circle: people who read more and read challenging books practise the associated skills more and constantly improve as a result. The research team also discovered that reading behaviour is strongly correlated with the children's' other linguistic performances: children who are familiar with a lot of children's literature have a bigger vocabulary and read more fluently. Unfortunately, however, the opposite case is far more common: children who have difficulties with reading avoid it. Accordingly, it becomes increasingly difficult for them and they avoid it even more.

Although reading research has long observed this complex interaction between what children read and what they can achieve, the best course of action to be taken still remains unclear. The solution definitely lies in a combination of different measures: teachers have an important role to play, however, they frequently lack the time needed to focus on the individual reading behaviour of their pupils. Reading mentor systems are undoubtedly good, however, the sustainability of the effect of such generally sporadic measures is unclear. Programmes for the promotion of reading motivation are also good and useful, but they are generally too unspecific from a cognitive perspective. Weaker pupils, in particular, who find it difficult to decode the simplest of words, require targeted support and practice so that they reach a stage where they can continue to read independently. This is the decisive factor: instead of sending children to weekly sessions of reading support or forcing them to do five minutes of reading at home as prescribed by their parents, it is important to strengthen the children's 'cognitive immune system' in such a way that they are able (and willing) to grapple independently with books and texts – irrespective of whether they come in the old-fashioned paper form, as e-books or are found on the internet.

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