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What is ‘dyscalculia’?

The DCSF has described dyscalculia as: ‘A condition that affects the ability to acquire mathematical skills. Dyscalculic learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers and have problems learning number facts and procedures.’ Colloquially it is called a ‘lack of number sense’.

Dyscalculic children and adults have a very particular disability – they are otherwise perfectly capable in thinking and learning. Many are professionals and some achieve post-graduate degrees. But it’s important for teachers to be aware that dyscalculics think about numbers in a unique way. This creates learning difficulties if they have to learn in a conventional maths class.

For example, it’s hard for dyscalculics to recognise number patterns, so many of them always count the number of hearts on a playing card. And they don’t easily remember the conventional procedure.”Colloquially it is called a ‘lack of number sense’.

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Teacher control in the games

An additional feature of these programs is that the teacher can control the pedagogy. Each program has a ‘teacher preferences’ page where the teacher can change how the program operates. For example, in Dots2Track, the teacher can decide how many times the learner has to get a pattern right before the program moves on to the next.

Numberline is the same. The teacher can set the maximum and minimum numbers, and the sequence of numbers to be displayed as targets, in case there are particular types of numbers they want the learner to rehearse. They can decide whether the program goes up into the thousands or tens of thousands, or back into negative numbers, or into decimals. All these games collect and monitor learners’ data – counting how many wrong or right answers were given and how long they took to choose. This data can be analysed to measure the children’s progress. That helps our designers make new versions of the programs.

The website is also a hugely valuable resource for getting ideas for improvements from the teachers who download and use the programs. Comments for Numberline include:

“Could it work with a part-filled number line as an extension activity? E.g. just the multiples of 10?”

“The number line exercise could be extended to finding a number within unmarked intervals in order to test sequencing and understanding, estimating as well as part-filled”.

What’s next?

It’s early days for this project, but so far children who are struggling with maths are responding very positively to these programs, returning to them many times to practice the basic concepts in ways that are difficult in the mainstream classroom. Teachers like the programs too because they are targeted. In future developments, we developed several exemplars of teacher-customisable personalised programs with a small group of SEN teachers in London schools.

The programs are simple interactive games that teach basic mathematical skills. There are many educational software programs available for school maths, of course, but unfortunately they are of little help to dyscalculics, because (a) they have busy, distracting screens, (b) they randomly generate the tasks, (c) questions are multiple choice – which prompts guessing and (d) feedback is mainly right/wrong – which is no help to a learner who cannot yet make sense of the concepts.

By making the programs adaptive to the learner, we are trying to offer the same kind of personalised help a small group SEN teacher can give. What the programs cannot do is engage the learners in dialogue about what they are doing. This is a very important part of the pedagogy used in SEN groups and, of course, computers are no good at natural language. But they are good at repetition and instant feedback.

If the child is working slowly or inaccurately our programs keep the tasks simple. If they start getting it right or working more quickly, it progressively changes the difficulty of the task. That is what ‘personalised learning’ ought to mean – and computers can offer it.

Game one: Dots2Track

The Dots2Track game is one of these programs. It is designed to help learners recognise a dot pattern without counting it. The game displays a number pattern (1 to 10) and asks the learner to key in how many dots they see. If they get it right, the pattern is transferred instantly to a number line. If they get it wrong, it is counted onto the line by dot by dot (visually and with sound). The student can see their response next to the correct response, then fix theirs by adding or taking away until it matches.

By counting the pattern onto a number line, the program makes a meaningful link between the pattern and the digit. Then, once the learner has become familiar with this relationship, the program (or the teacher) can adjust how many seconds the pattern will be displayed for before it disappears. This technique motivates the learner to memorise the pattern, without counting, to identify it.

Game two: Numberline

Dyscalculic children asked to count in 10s will often make the mistake of counting “70, 80, 90, 100, 200, 300…” as they expect a number...
SEN

teachers will be able to view their learners’ progress reports.

Many of the programs have also proved effective with mainstream learners. Teachers have said that the programs are good for year four children who still need to do year one activities – so they also work well for year one children.

Another advantage of the very simple screen designs is that they are not childish. These programs would be equally valuable for adult dyscalculics – many of whom have found ways of getting round their problem for years but still lack basic understanding.

We are continuing our research and developing more games like this. We aim to capture the imagination of schools, organisations and teachers. If we succeed in this, and get the funding we need, we intend to develop intelligent personalised applications to cover all the fundamental arithmetic concepts.

Hassan Baajour and Professor Diana Laurillard work for the London Knowledge Lab on the BECTA funded project ‘Digital interventions for dyscalculia and low numeracy’. They would love for readers to help by testing and commenting on the programs, so please register at low-numeracy.ning.com.

2. http://www.lkl.ac.uk

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