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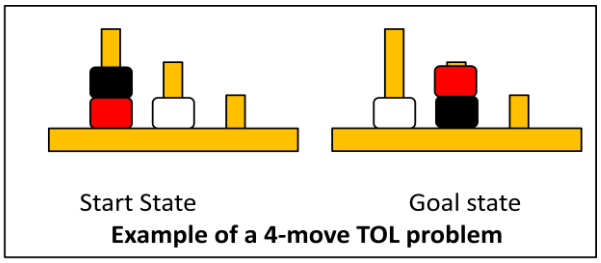
Summary of PhD Research: Joanne S. Camp

The development of problem-solving abilities in typical and atypical development.

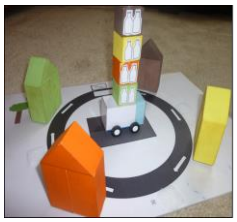
I began my programme of PhD study in 2010, under the supervision of Professors Emily Farran, Michael Thomas and Annette Karmiloff-Smith. I am very grateful to everyone who made the research possible, including participants, parents and schools. I have now completed writing my thesis and passed the examination process, and am writing up the results for publication in academic journals. This is a summary of the findings which are most relevant for the Down syndrome group.

Problem solving is a skill that we use constantly in everyday life, whether we are completing a jigsaw puzzle or looking for a new place to live. It depends on skills known as executive functions, including the ability to plan ahead, keep items active in short-term memory (working memory), switch attention flexibly (shifting), and hold back responses before they are made / maintain focus (inhibition). In this programme of research we aimed to find out more about how executive functions are used for problem solving on a puzzle-type task, as well as for everyday problems, like finding a lost possession. We investigated this for individuals Down syndrome (DS), individuals with Williams syndrome and typically developing children. In the Down syndrome group, 20 participants (aged 12-24 years) completed a range of tasks assessing different executive functions and the Tower of London problem-solving task. The tasks we used are illustrated below.

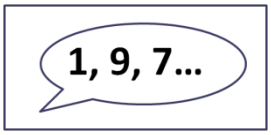
Problem-solving task (Tower of London)

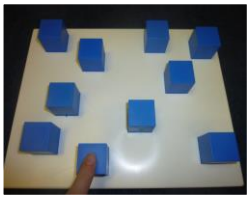


Example of a 4-move TOL problem



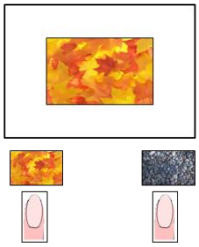
Planning: van loading in reverse

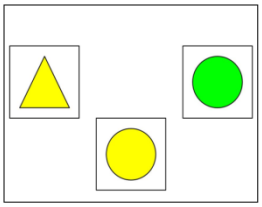




Working memory: remembering a sequence of taps on the blocks, and a sequence of spoken numbers

Inhibition: press Same, then Opposite





Shifting: sort by different criteria (e.g., shape, colour)

In addition, parents completed two questionnaires to provide information about everyday executive functioning and problem solving. The BRIEF (completed by 30 parents, including 14 of the parents of the 20 who had participated in the experimental tasks) consists of scores on eight scales of everyday executive functions (Inhibit, Shift (allocating attention flexibly), Emotional Control, Working Memory, Plan/Organize, Organization of Materials (keeping possessions in order), Monitor (monitoring of one's own behaviour), and Initiate (starting an activity or producing ideas). The Problem-Solving Questionnaire (completed by 31 parents) asks how their son/daughter would react if presented with a problem with an everyday routine (Getting Dressed, Brushing Teeth) or more novel scenario (Finding a lost possession; Packing a bag for the day; Putting items away in a wardrobe or chest of drawers).

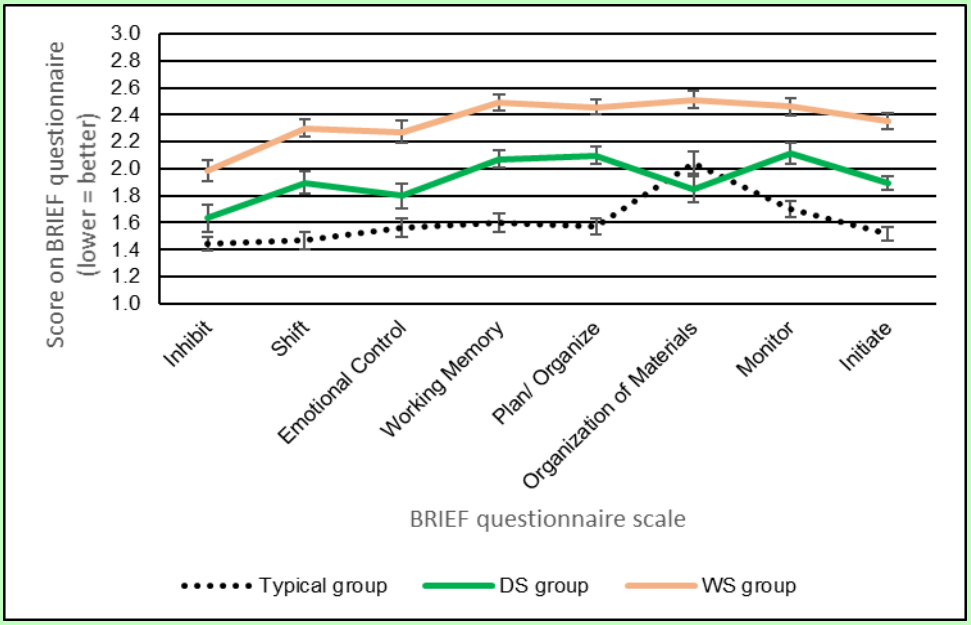
Results and Conclusions

Everyday problem solving in DS

The DS group in our study (with an average age of approximately 17 years) were rated by parents/guardians as more likely on average to reach the solution to everyday problems than the group of participants with Williams syndrome of a similar age and nonverbal ability. The DS group were also rated as less likely to reach solutions than a group of typically developing children with an average age of approximately 8 years.

Is keeping things tidy a problem-solving strategy for the DS group?

On the BRIEF questionnaire, the DS group were rated as being good at keeping their possessions in order, and our statistical analysis suggested that this marked them out as having a different pattern of results compared to the Williams syndrome and typical groups.



Although more research would need to be carried out to ascertain whether this is the case, we think that keeping things tidy could be a useful strategy that individuals with Down syndrome might already be using to help them manage their everyday problem solving.

Asking for help

We were interested in the reasons why somebody might succeed, or not, with an everyday problem, so we asked parents to tell us how likely their son/daughter was to react in certain ways to everyday problems. While changing their response, keeping focused and not giving up were associated with reaching the solution for all the groups, the DS group were unique in that asking for help was linked with their problem-solving success. This suggests that asking for help is another strategy people with DS are using to manage everyday functioning.

One thing at a time

On the Tower of London problem-solving task, although the DS group found it difficult to keep to following the rules of the game, they still performed at about the same level as the group of typically developing children (average age 5 years 10 months) who had a similar level of nonverbal cognitive ability. We think they may have been compensating for difficulties with planning ahead by approaching the problem one step at a time.

I'd like to say another **huge** thank you to all of the participants, parents, teachers, schools and everyone else who made this work possible! I am also very grateful to the Williams Syndrome Foundation and Down Syndrome Association for help with recruitment. If you have any questions about the research please email me at j.s.camp[at]reading.ac.uk.