The Bloomsbury Colleges
University of London

Leading education and social research
Institute of Education
University of London

Birkbeck
UNIVERSITY OF LONDON

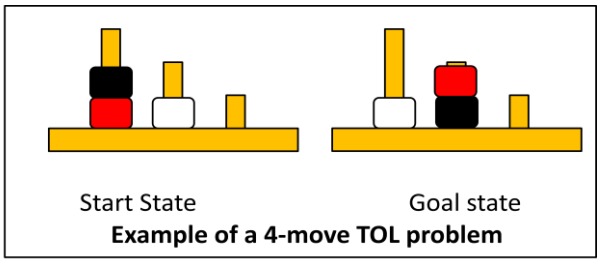
Summary of PhD Research: Joanne S. Camp

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

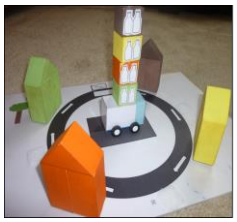
I began my programme of PhD study in 2010, under the supervision of Professors Emily Farran, Michael Thomas and Annette Karmiloff-Smith. I am very grateful to everyone who made the research possible, including participants, parents and schools. I have now completed writing my thesis and passed the examination 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 Williams 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 Williams syndrome (WS), individuals with Down syndrome (DS) and typically developing children. In the WS 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.

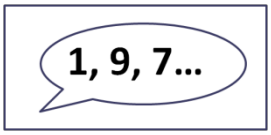
Problem-solving task (Tower of London)

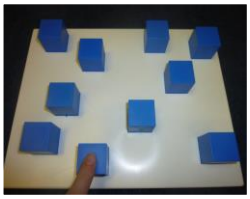


Example of a 4-move TOL problem



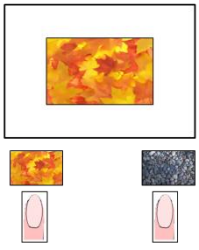
Planning: van loading in reverse

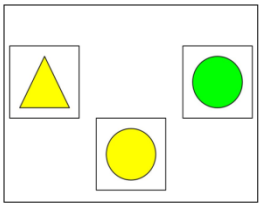




Working memory: remembering a sequence of taps on the blocks (visuospatial), and a sequence of spoken numbers (verbal)

Inhibition: press Same, then Opposite





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

In addition, parents' responses to two questionnaires provided information about everyday executive functioning and problem solving. The BRIEF (completed by 46 parents) 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 47 parents) asks parents about 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).

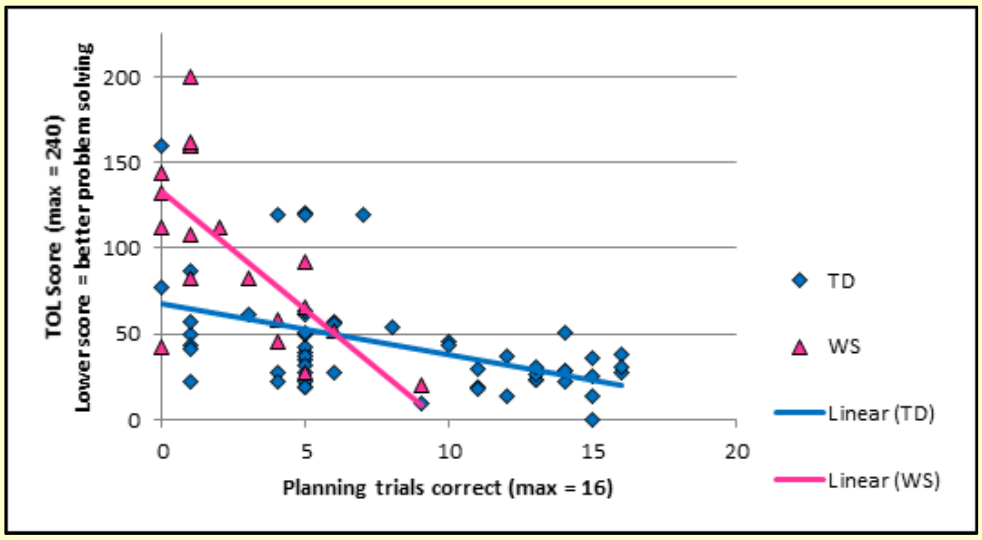
Results and Conclusions

Problem solving ability levels in our WS sample

WS performance on the Tower of London (TOL) problem-solving task (20 individuals, aged 17 years, 8 months on average) was poorer than the performance of a group of 20 typically developing children of a similar nonverbal cognitive ability (average age 5 years, 10 months). For everyday (questionnaire) problems, the WS group of 47 individuals (aged about 18 years on average; 16 also completed the TOL and other tasks) were rated as less likely on average to reach the solution to everyday problems than both a group of 31 participants with Down syndrome of a similar age and nonverbal ability, and a group of 34 typically developing children with an average age of around 8 years.

An over-reliance on planning ahead for problem solving in WS?

Like the typically developing children, performance on the planning and backwards visuospatial working memory tasks were both related to better TOL problem-solving performance in WS. However, when we looked at the nature of those relationships, the association between planning and problem-solving looked unusual for the WS group. Compared to the typical group, they demonstrated a stronger relationship (shown by the steeper line) between planning and problem solving for the participants with lower planning scores. Therefore, problems with planning ahead could be what limits some individuals' problem-solving abilities, as they may rely more on planning than typically developing individuals.



Becoming Emotional

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, being more likely to become emotional during solving was also related to difficulties with problem-solving for the WS group.

Watching your words

For the WS group, having a larger vocabulary was associated with being rated as more likely to reach solutions for routine, but not novel, PSQ scenarios. Even if somebody with WS speaks fluently (and sounds like they could handle a problem-solving situation), their language won't necessarily tell us about their problem-solving ability. We should take care not to allow our expectations of someone's ability to be influenced by their verbal skills.

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.