Research Findings

Supporting Children with Mathematics Learning Difficulties: An Intervention Programme with primary school children

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Research Aims

- To investigate whether the participants make any improvement in the components assessed through the Dynamo Profiler over an eight week period;
- To conjecture which of the components assessed are most malleable and therefore which ones would have improved and might have had an effect on other components;
- To develop a better understanding as to what seems to be effective in intervening for mathematics learning difficulties.

Research Questions

- Do the participants show any improvement in the Dynamo Profiler assessment after 8 weeks of following intervention with Dynamo Maths?
- If subjects have improved, what has contributed to this improvement?
- Which components have improved and therefore are most malleable?
- Is there a difference between the progress made in the components intervened upon and in those not intervened upon?

Participants

The participants were selected with the help of the classroom teachers. All the participants were identified as struggling with maths.

The sample size selected was composed of **10** participants.

5 were selected as the **intervention group**.

The other **5** were asked to ask as the **control group**.

All participants were in Grade 3 (7 to 8 years old). They all attended the same Church school for boys in Malta thus reducing variables.

Qualitative Data Collection Process

Pre-Assessment done using **Dynamo Profiler** with **all** of the 10 participants. Assessment was carried out on a one to one basis and observations were noted.

Dynamo Maths intervention programme was carried out with the 5 **pupils** in the intervention group. This was done over an **8 week period**. Sessions were held for **15 minutes** everyday (sometimes the children missed a lesson due to school activities – this occurred about 7 times across the weeks).

Post-assessment was carried out using **Dynamo Profiler** with **both groups** of children. Assessment was carried out on a one to one basis and observations were noted.

All the data was collected by one of the researchers thus reducing variables and increasing validity and reliability.

Dynamo Profiler

- The Dynamo Profiler assesses 15 components of arithmetic. These are: direction and spatial orientation, visual discrimination and approximation, number as symbols – single digit, counting, number as symbols – double digits, comparison, estimation, ordering numbers, number sequencing, number facts, mental strategies, number bonds, problem solving, time and multiplication.

- The Profiler outlines the strengths and weaknesses of the learners in each of the 15 components and outlines which Modules from the Dynamo Maths Programme would be most helpful.

- It also highlights whether the difficulties encountered are related to dyscalculia symptoms or maths developmental delays.

Dynamo Maths Intervention

- The intervention programme suggested by the Dynamo Profiler is tailor-made to suit the needs of each learner.
- Dynamo 1 and Dynamo 2 focus on number sense whilst Dynamo 3 and 4 focus on number proficiency.
- Each Dynamo has a number of modules. Every module has lesson plans, worksheets and on-line activities for the educator to make use of.

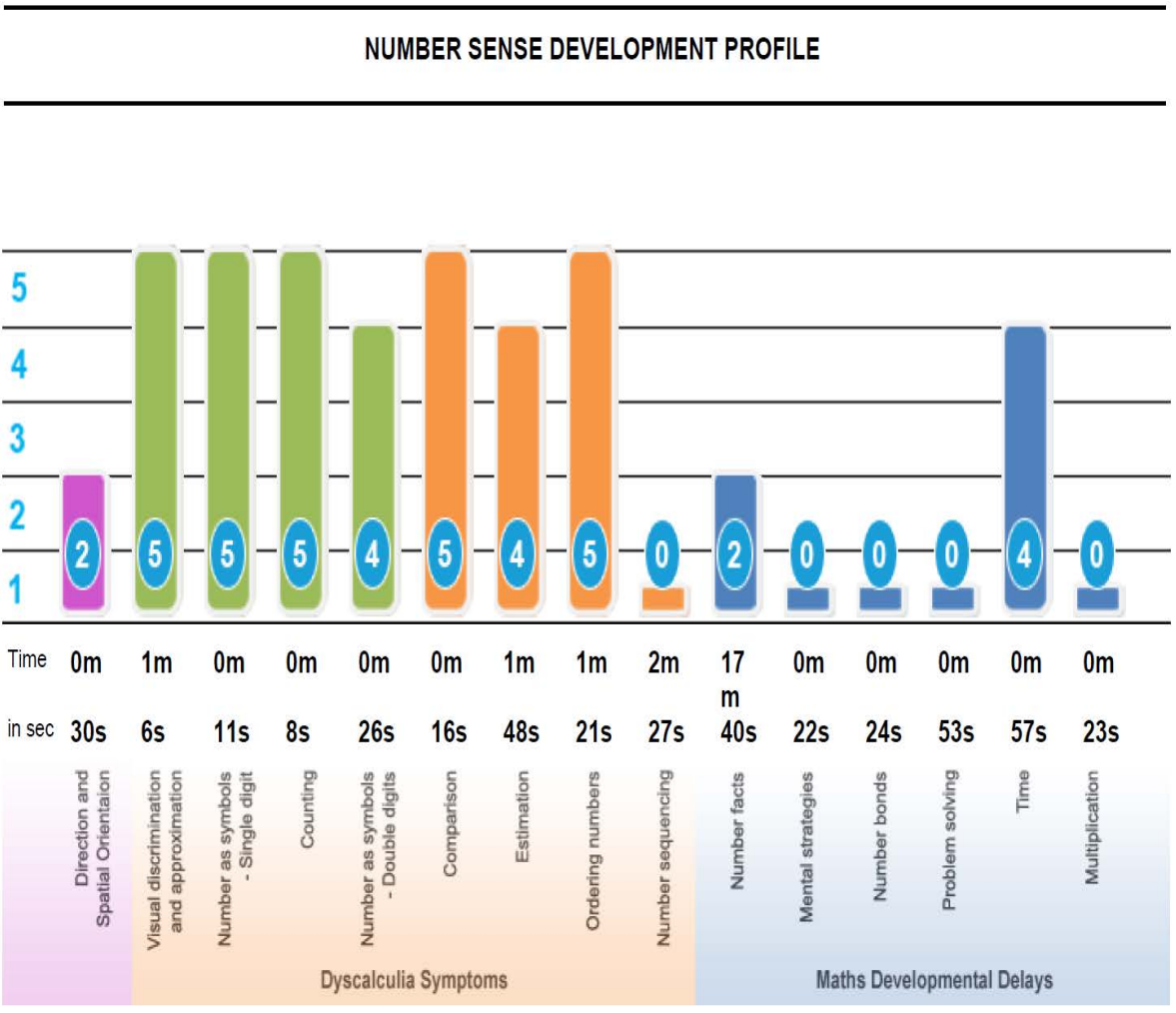
Findings

- The Dynamo Profilers of the children who had undergone intervention showed improvement in most components, while the control group made less progress.

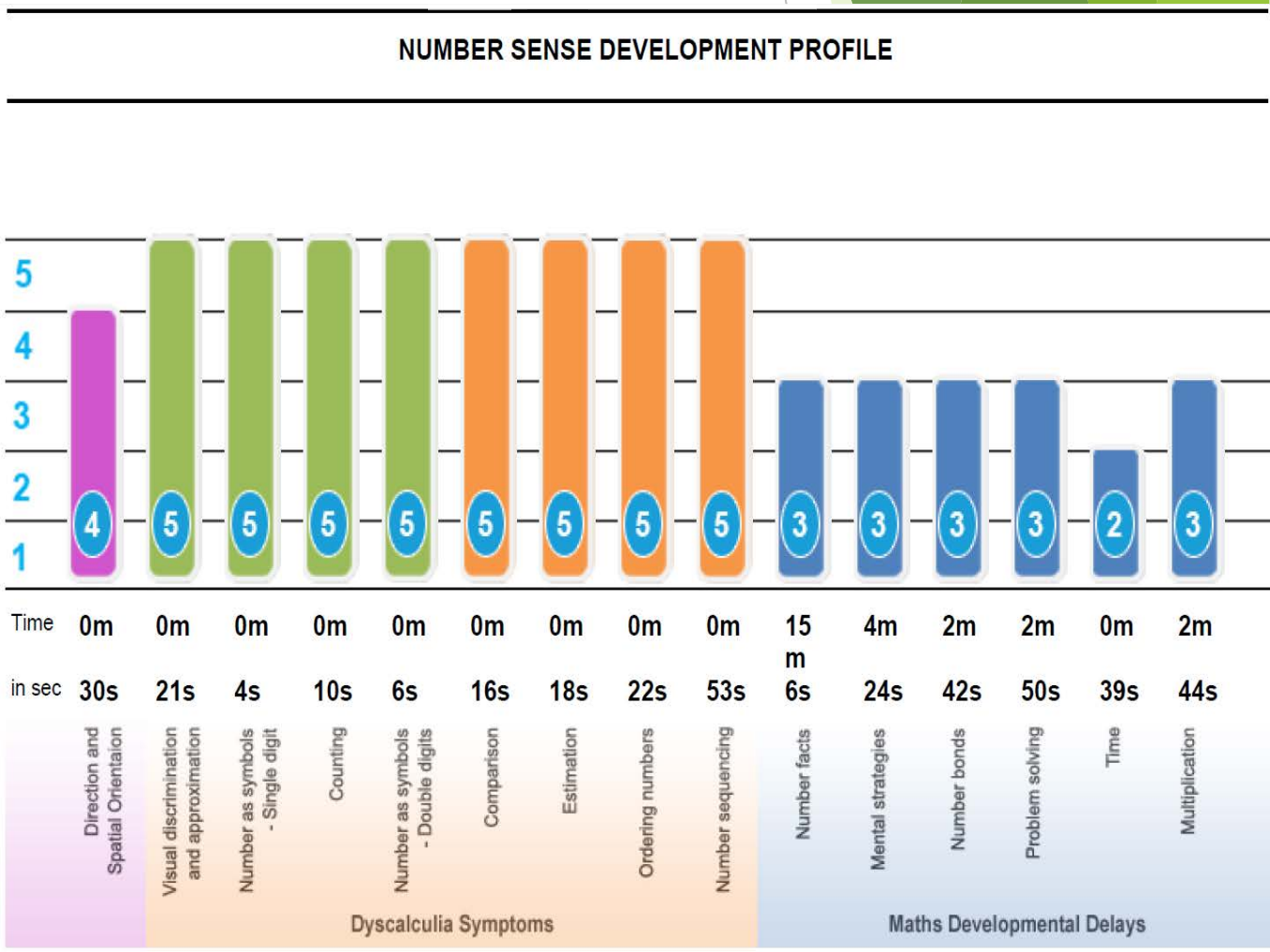
- Some example are given in subsequent slides.

Intervention Group – Student 1

Pre-Assessment

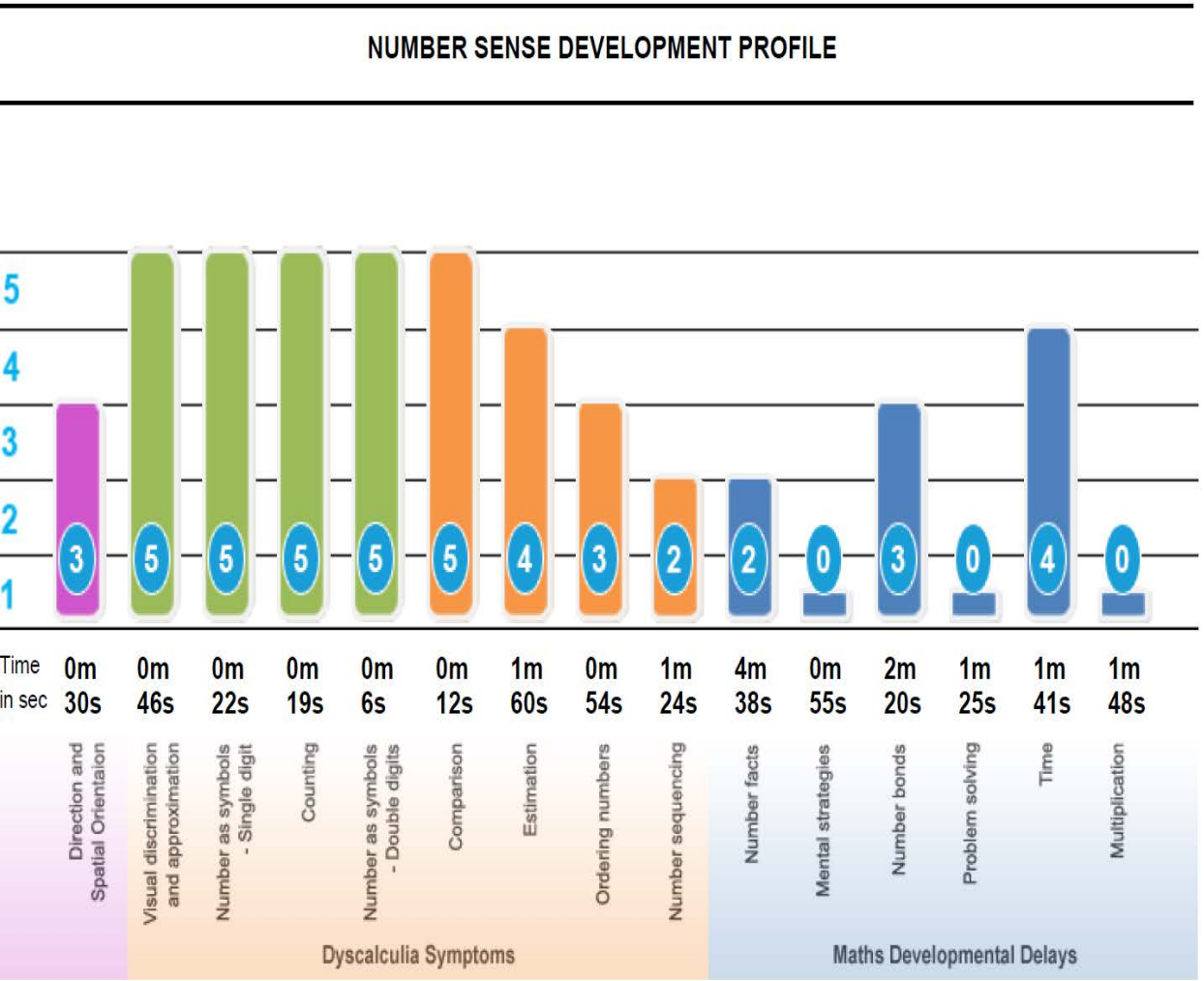


Post-Assessment

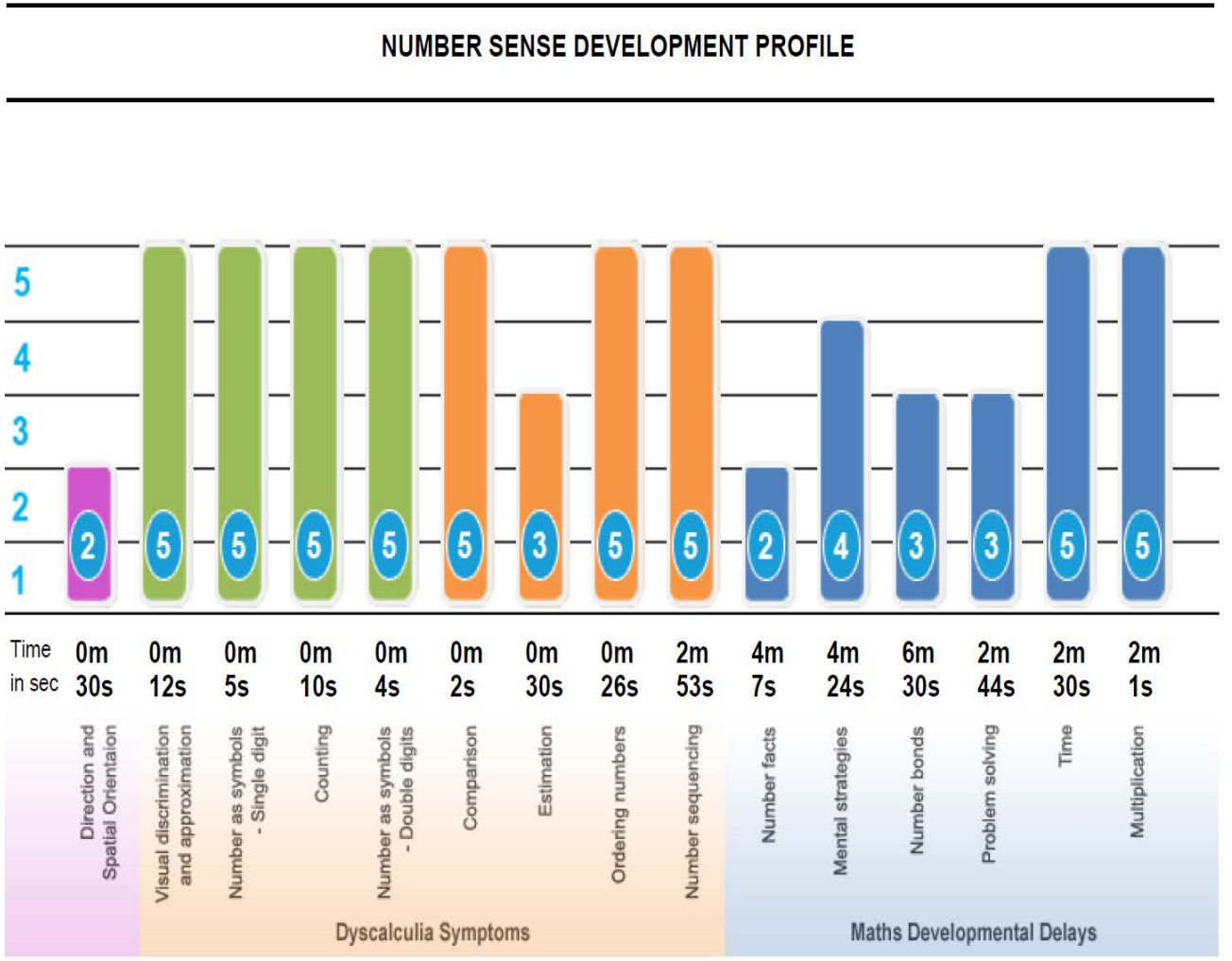


Intervention Group – Student 2

Pre-Assessment

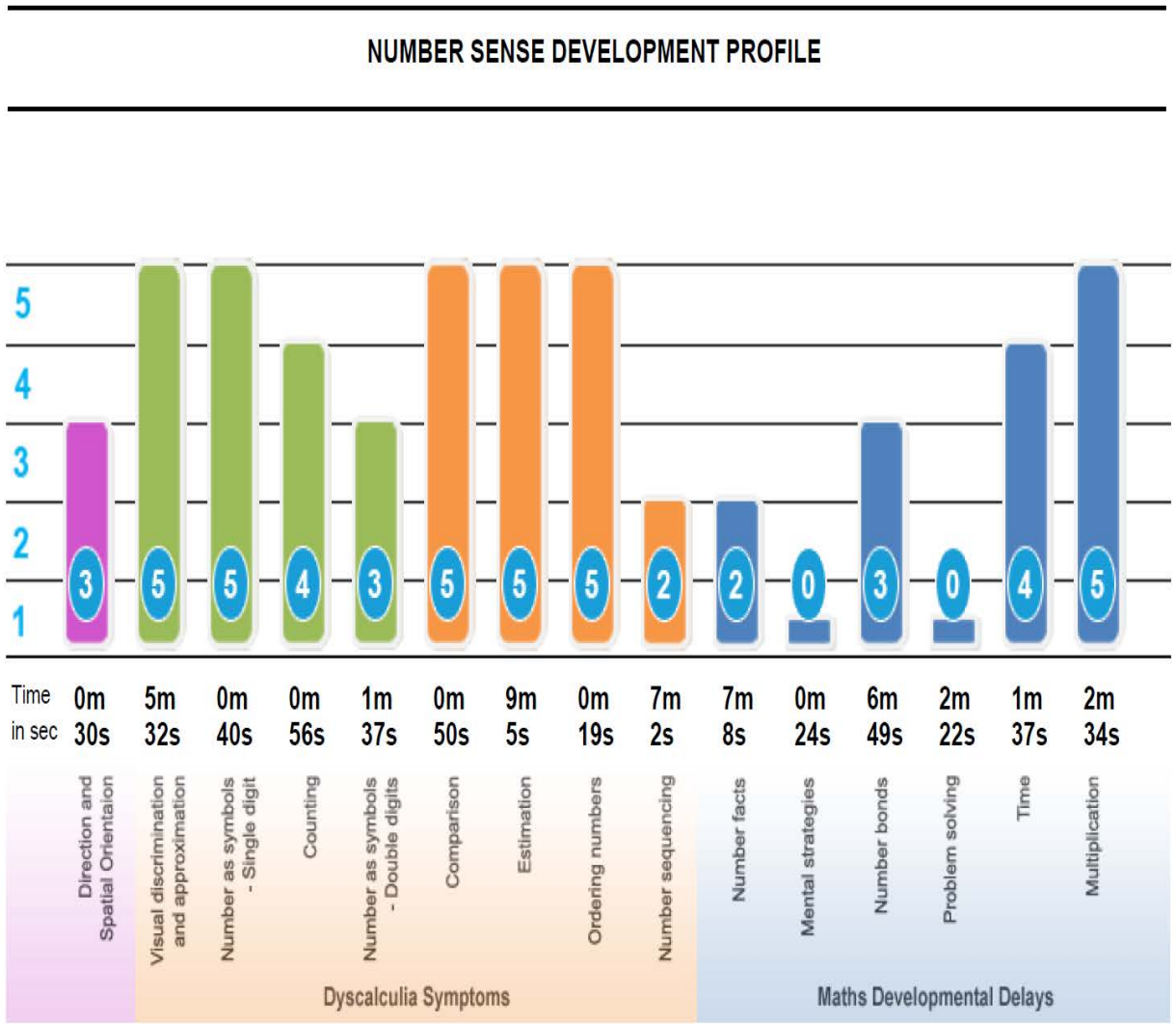


Post-Assessment

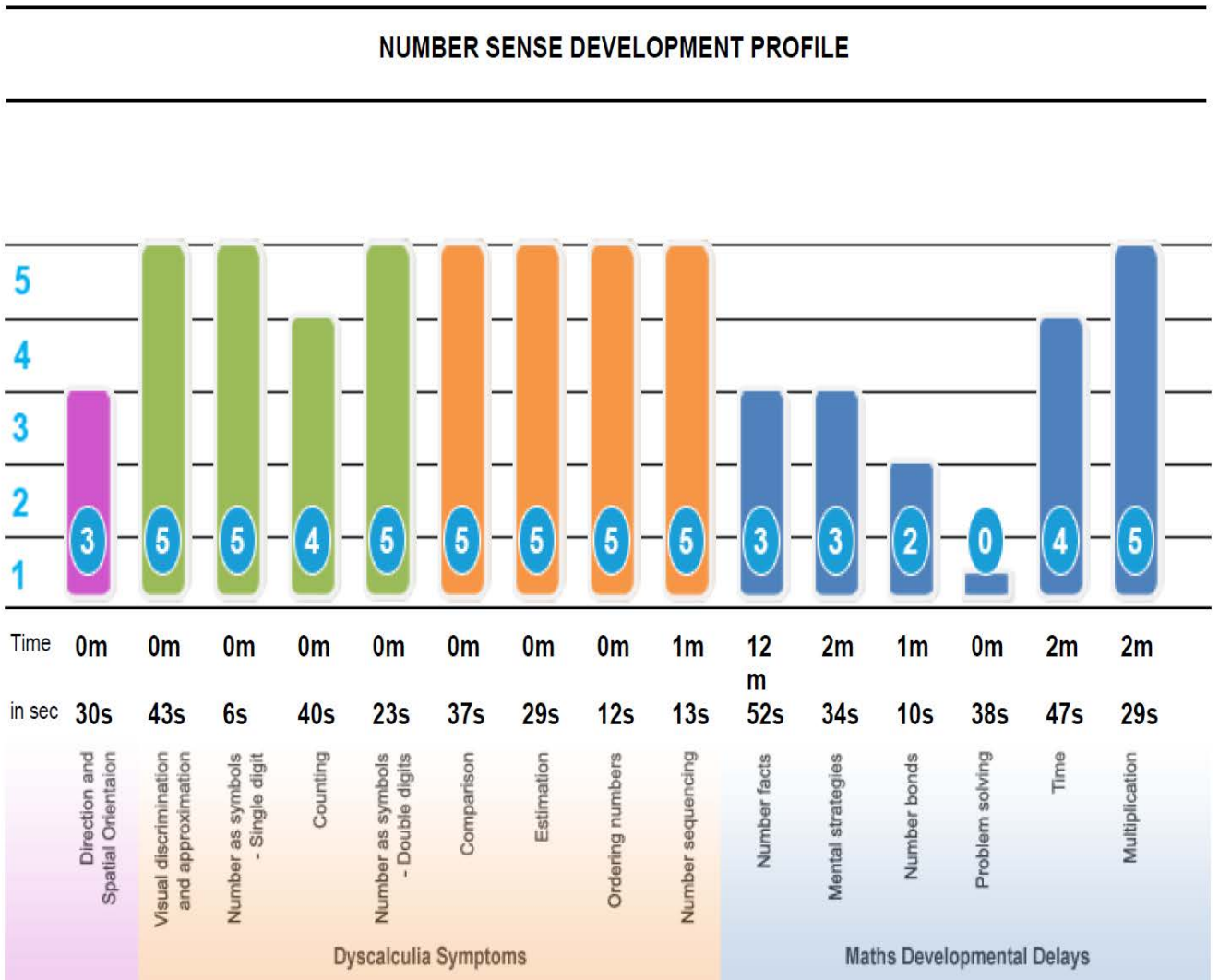


Control Group – Student 1

Pre-Assessment

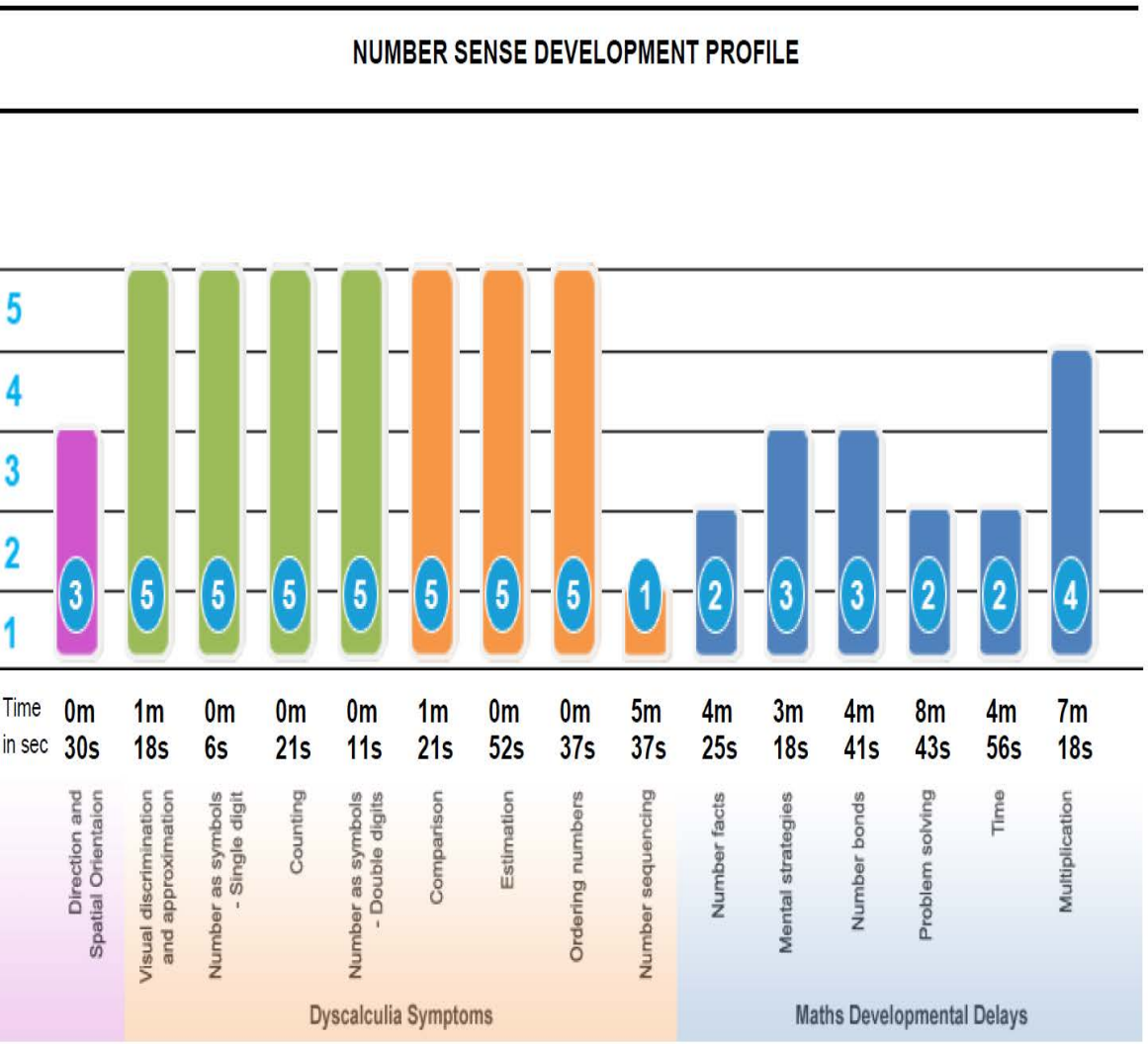


Post-Assessment

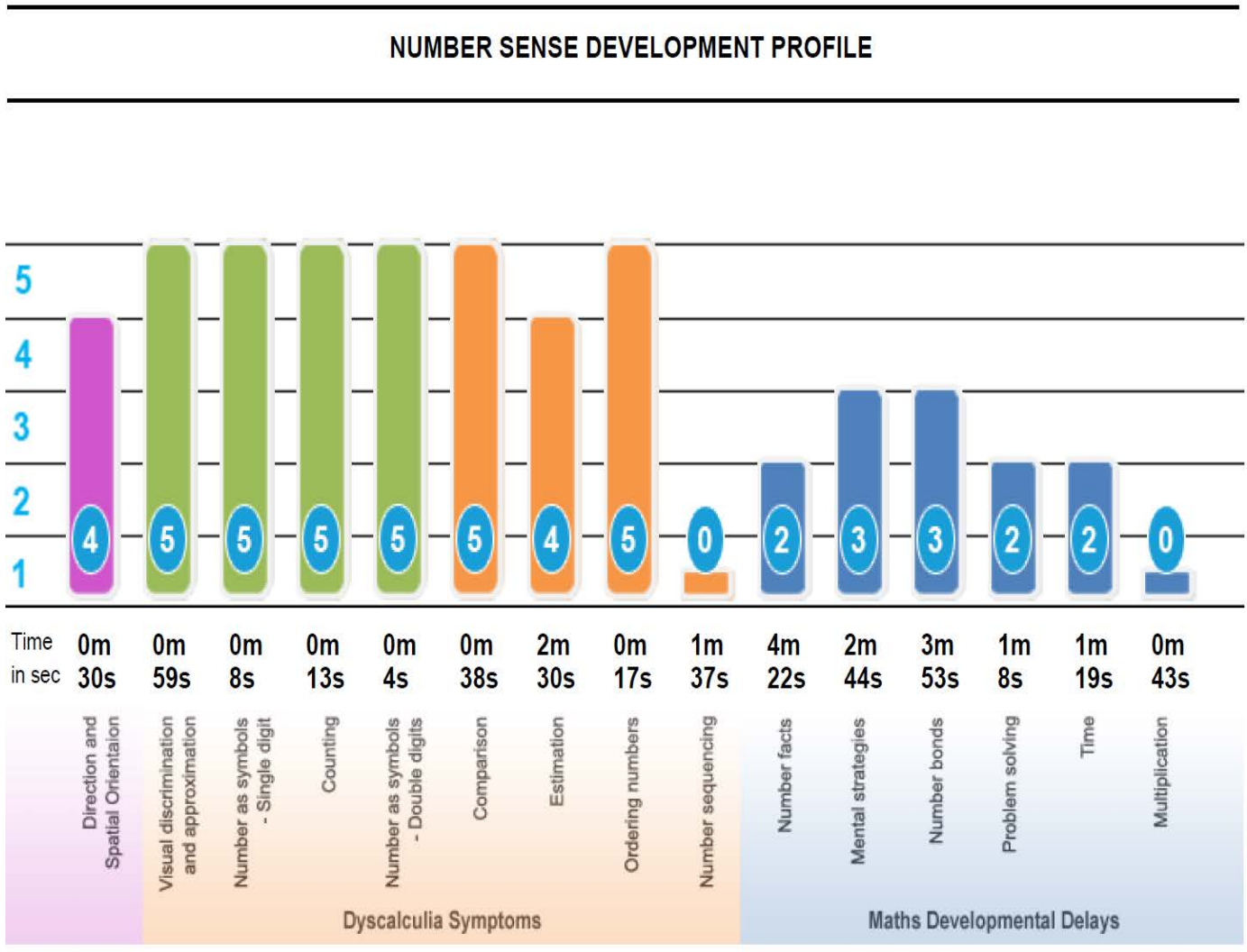


Control Group – Student 2

Pre-Assessment



Post-Assessment



Componential approaches to intervention

- Approaches to intervention in mathematics may work best when they take into account individual children's specific strengths and weaknesses in arithmetic, and do not assume that 'one size fits all'.

Observations

- For most of the intervention group the Dynamo Maths programme had a positive impact on the Dyscalculia Symptoms highlighted by the Profiler illustrating that these symptoms are malleable and can be positively improved if specific intervention is provided to target each of them.

- Once the Dyscalculia Symptoms were strengthened, these seemed to have a positive effect on other components including multiplication, problem solving and number bonds. This because even though these were not targeted directly during the intervention sessions (due to a lack of time) the children's abilities in them showed progress in the post-test.

Further Observations

- The pre- and post- assessment of the Intervention Group revealed that the learners did progress in most components and little regression was recorded.

- When analysing the Control Group one observes that regression is more common and not only did progress thus not be recorded but the learners also seemed to loose some of their abilities – possibly due to the lack of making use of them.

Further Observations

- The attitudes towards mathematics as identified by each of the students whilst being assessed using the Dynamo Profiler did not seem to be effected by the intervention. Children who for example said they 'enjoyed maths' or 'found maths hard' at the beginning of the intervention programme maintained the same attitude. This was similar to the Control Group.

- This may be because the intervention programme was rather short and may indicate that for attitudes to change the intervention needs to be carried out on a longer time span.

- Attitudes form part of the affective domain. From the results of this study one may conjecture that cognitive abilities may indeed be more easily malleable than attitudes and beliefs that form part of the affective domain.

Findings correlate to Literature

- There is nothing like *mathematical ability* but that it is best to speak about *mathematical abilities* (Dowker, 2005). The Profilers illustrate how all the learners identified as struggling with mathematics had in fact different profiles of strengths and weaknesses.

- Mathematics has a componential nature and specifically targeting one component at a time can not only scaffold the progression in the targeted components but also in a number of other components (Dowker & Sigley, 2010; Holmes & Dowker, 2013).

- Specifically identifying the gaps in the pupils' learning is fundamental to any effective intervention programme for mathematics.

Why might have the Intervention been effective?

- The intervention programme embraces scaffolding and all lesson plans, worksheets and online activities are scaffolded to in their content and the ways in which they are presented.
- A Multisensory Approach to the learning of mathematics is promoted in all the lesson plans. The lessons are built around giving the learner the image and context as well as the symbols (Haylock and Cockburn, 2013).
- Its digital activities are very attractive for the learners. They not only praise the learners for the successful completion of a task but also illustrates why an answer is wrong when this is the case.
- Learners can follow up what they have done at school, also at home.
- The pupil can repeat the same online activity as many times as needed or wanted. The progress of the child in all the activities is consistently monitored.

Conclusions

- Children with mathematics learning difficulties normally exhibit difficulties with specific components of mathematics and not **all** components;
- If specific intervention is provided to target different components, progress is highly likely;
- Making a difference in the cognitive abilities of the learners may be less problematic than doing this within the affective domain;
- Scaffolding and a Multisensory Approach to the teaching of mathematics may be fundamental for appropriate intervention for mathematics learning difficulties;
- Dynamo Profiler and Dynamo Maths illustrate how technology can be used as a great tool to support children with mathematics learning difficulties since it can be accurate and specific in its assessment and also provide fruitful and enjoyable learning experiences to these learners who can in turn make much desired progress.