Two projects addressing learning difficulties and disabilities in mathematics

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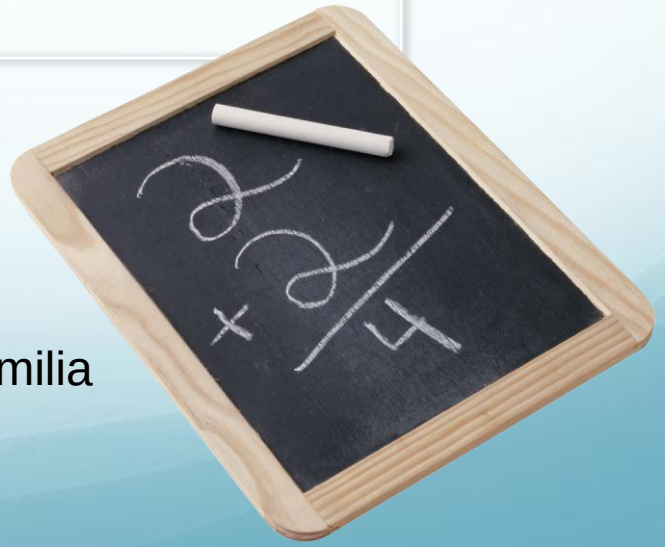

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First...a note on developmental dyscalculia (DD)

According to Butterworth dd is

"a highly selective and specific deficit of a very basic capacity for understanding numbers, which leads to a range of difficulties in learning about number and arithmetic."

"This proposal is based on the idea that we are born with a capacity specialized for recognizing and mentally manipulating numerosities (cardinal values) and that this capacity is likely to be embodied in specialized neural circuits."

(Butterworth, 2004, Handbook of Mathematical Cognition)

DD

and the UK Department for Education and Skills characterizes DD as:

“A condition that affects the ability to acquire arithmetical skills. Dyscalculic learners may have difficulty understanding simple number concepts, lack an intuitive grasp of numbers, and have problems learning number facts and procedures. Even if they produce a correct answer or use a correct method, they may do so mechanically and without confidence.”

(DfES, 2001, p. 2)

DD

As a result of the Consensus Conference in 2006 the Italian community has accepted the following definition of DD:

Disturbo a patogenesi organica,

geneticamente determinato,

espressione di disfunzione cerebrale

DD

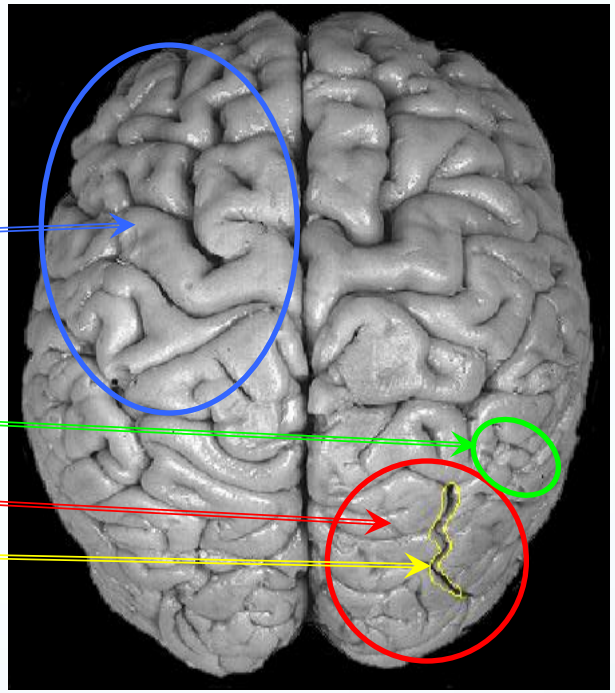
It is a learning disorder which is

- specific: there is a discrepancy between the subject's general intellectual level and her abilities in the specific domain of the disorder;
- developmental: it is expressed differently based on the developmental stage of the subject;
- neurobiological: the disorder can be genetically inherited or it may appear due to environmental circumstances;
- comorbid: it is frequently associated to other (but not always the same) learning disorders.

DD

The areas of the brain that seem to be affected are:

the left frontal lobe
(for more complex tasks)
the angular gyrus
the parietal lobe
the right intraparietal sulcus



Learning new arithmetical facts primarily involves the frontal lobes and the intraparietal sulci (IPS), but using previously learned facts involves the left angular gyrus, which is also implicated in retrieving facts from memory.

DD

Depending on the criteria used for the diagnoses in different countries for DD the prevalence estimates range from

3.6% to 6.5%

However it is important to consider the criteria used!!

The school of Lucangeli in Italy, for example, considers *false positives* many subjects who would otherwise be considered dyscalculics. A false positive is an individual who initially underperforms on the diagnostic tests but after a *period of strengthening* of her weak processes she increases her performance by at least 2 standard deviations.

Two Projects

PerContare a 3-year project by

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- developing and testing “good teaching practices” that make use of artifacts of both physical and digital nature;
- that involves entire classes of primary school children;
- to prevent the emergence of learning difficulties, that may later be diagnosed as disabilities;
- to train teachers according to these good teaching practices.

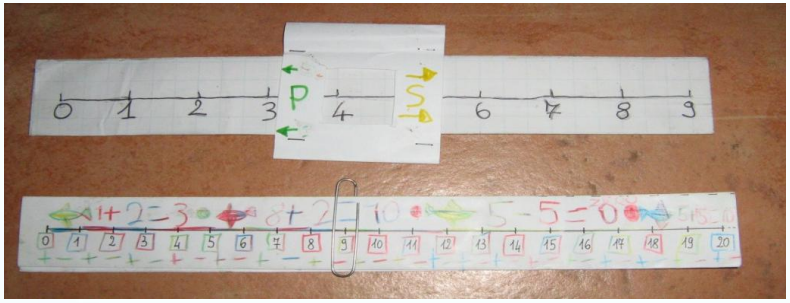
Matemozione is a “permanent” project

- that involves secondary school students with specific learning disabilities;
- to study features of existing software and develop new software and specific teaching strategies;
- to inform teachers and special educators about the potential of these teaching strategies and tools.

PerContare

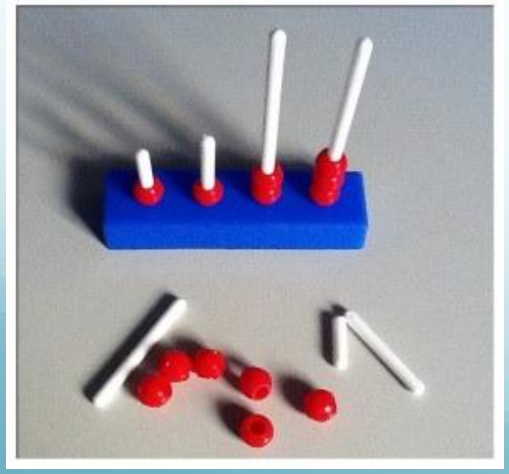
The physical artifacts we introduce are:

bee-bot



the number line

the abacus

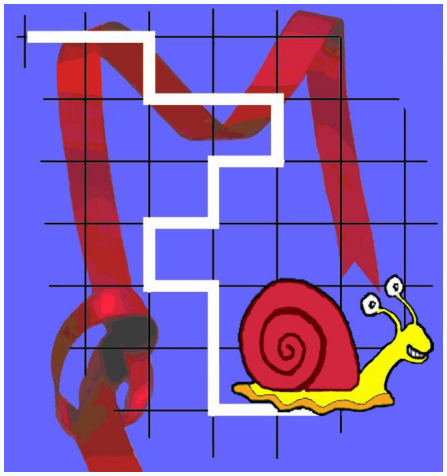


straws

the pascaline

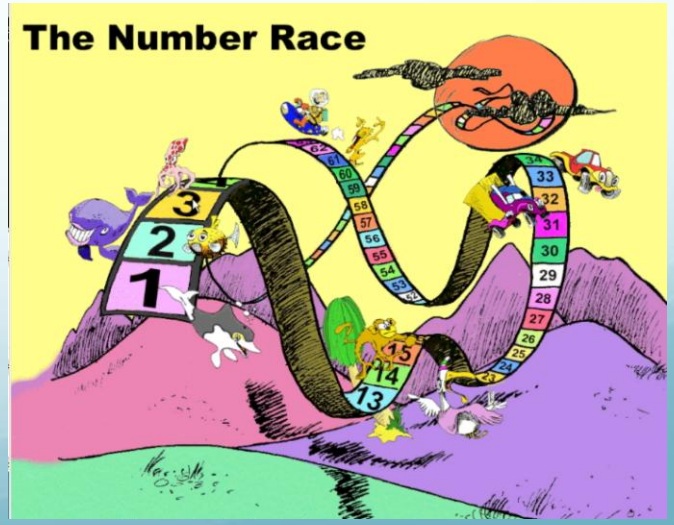
PerContare

Then there is software...for example



Mak-Trace

i piccoli matematici



PerContare

The teachers participated to a summer school during which they were introduced to many of the artifacts of the project, and to the framework the project is situated within (semiotic mediation). They were also introduced to DD by an expert clinical psychologist.

The teachers started keeping weekly diaries to document their activities.

In September all classes took an “entry test”. Then teachers proceeded independently. Some have already chosen to introduce the number line and bee-bot. They can request assistance via email and/or Skype.

After the screening in January we will assign 3 different pilot treatments each made of 15 activities to the experimental classes:

1. Bee-Bot, Focus on Bee-Bot, the number line

2. various activities with software for interactive whiteboards, the number line

3. working with fingers, the number line

We will then refine the treatments and use them next year, also basing our assignments on any correlation that may arise between post-test screening results and pilot treatments.

During the second (and third) year of the project we will:

- continue to develop and test activities in the same manner for second grade students;
- refine and test again first grade materials;
- expand the project to new schools in new regions;
- refine the screening tests for the first grade and develop a new test for the second grade;
- develop additional software for in-class and out-of-class use based on our ongoing findings.

Matemozione

Our first data are from work done by a special ed teacher at I.S. “E. Majorana” in Bologna with a student, Filippo, diagnosed with DD.

week they work with M Trace, a free app

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