Physics Education Laboratory
Lecture 17 - 25.11.2024
Learning Disorder in Physics Learning

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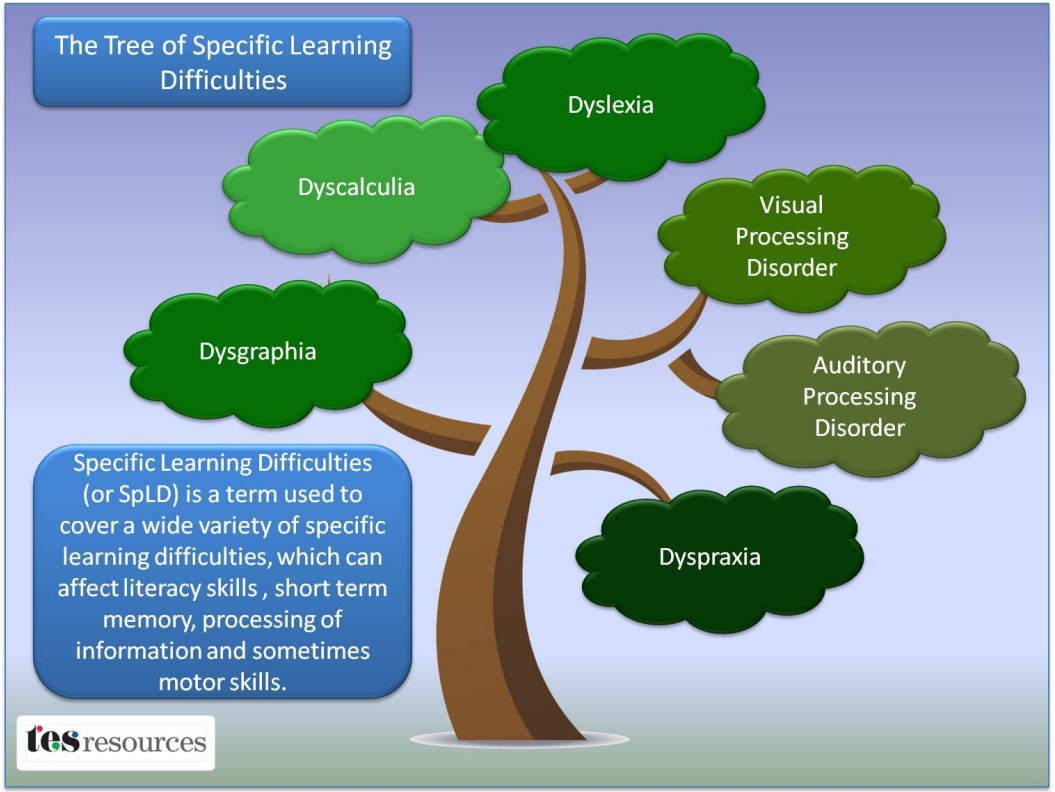
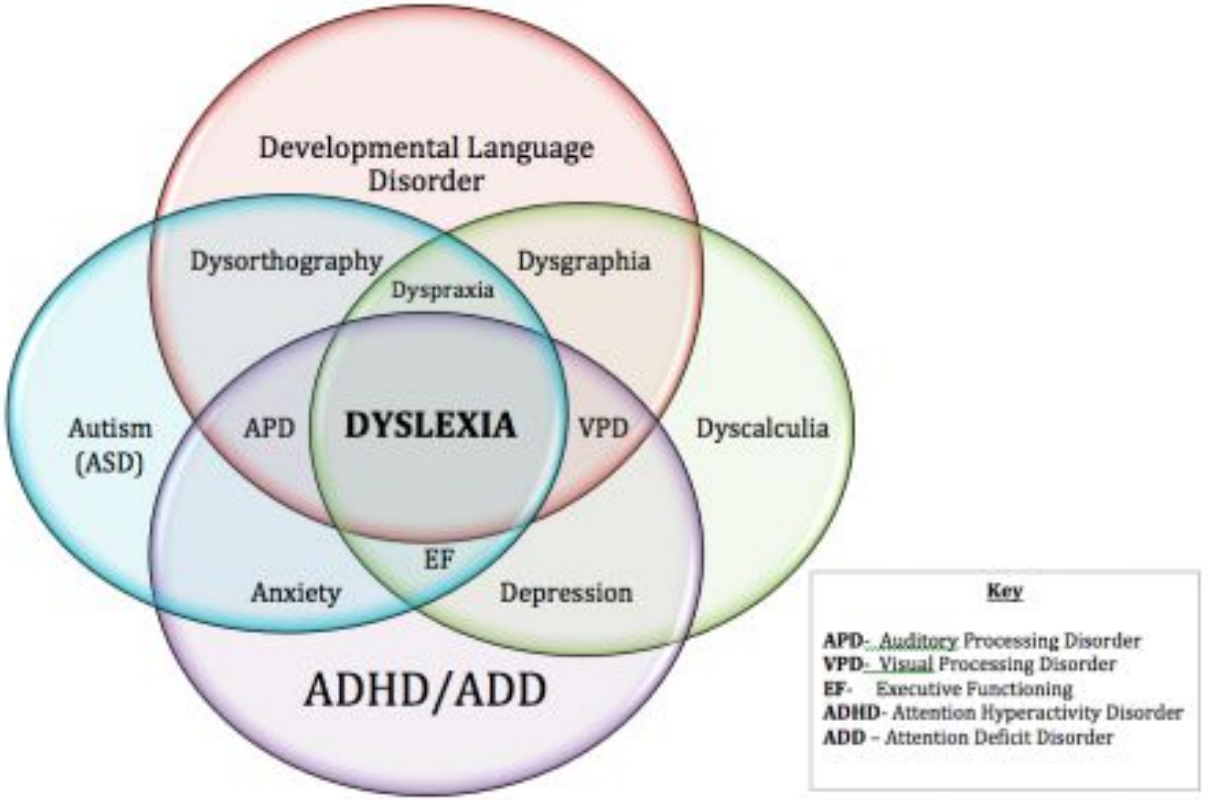
What are specific learning difficulties (DSA - disturbi specifici dell'apprendimento)?

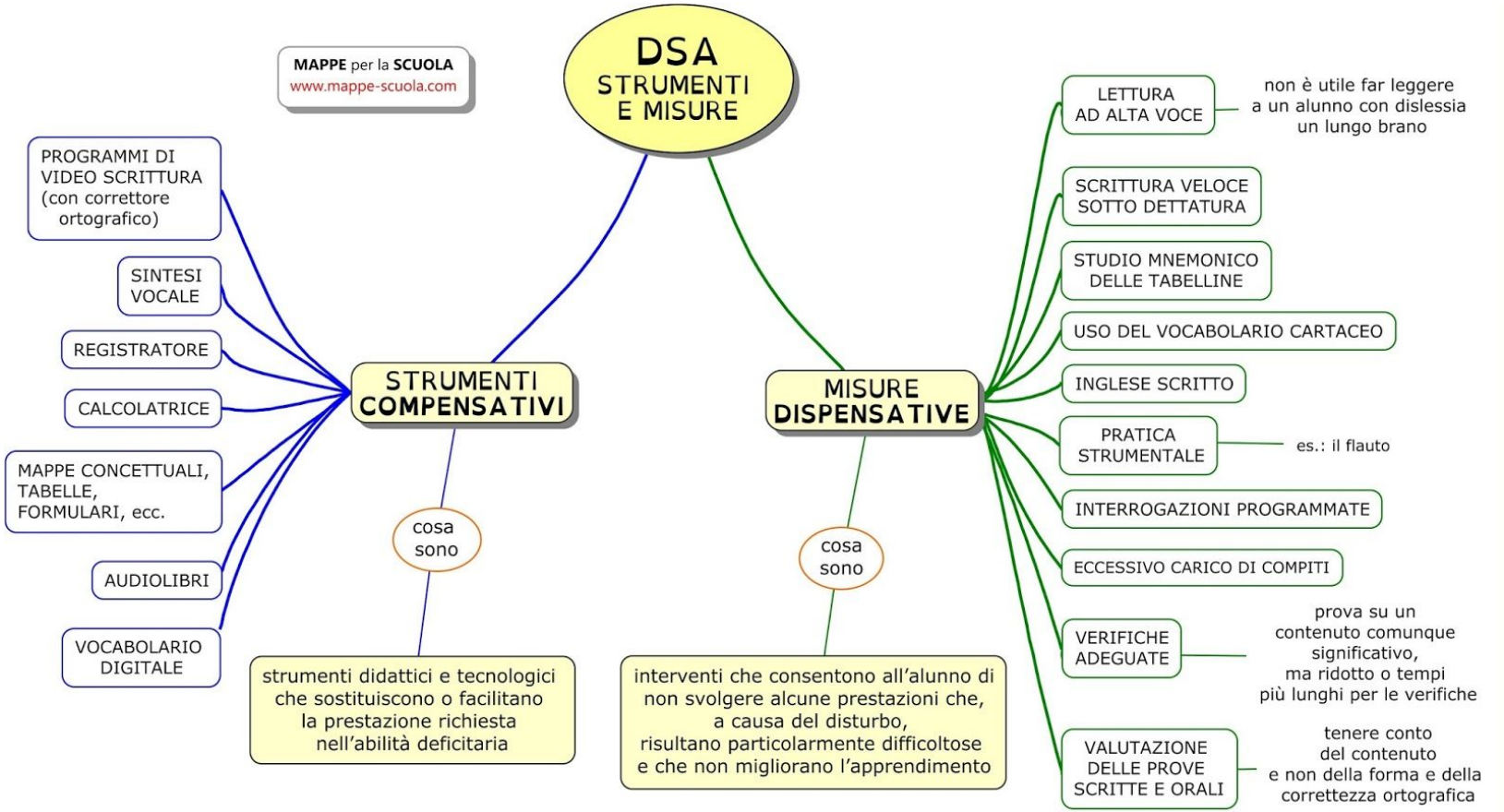


Common Types of Learning Disabilities		
Dyslexia	Difficulty reading	Problems reading, writing, spelling, speaking
Dyscalculia	Difficulty with math	Problems doing math problems, understanding time, using money
Dysgraphia	Difficulty with writing	Problems with handwriting, spelling, organizing ideas
Dyspraxia (Sensory Integration Disorder)	Difficulty with fine motor skills	Problems with hand–eye coordination, balance, manual dexterity
Dysphasia/Aphasia	Difficulty with language	Problems understanding spoken language, poor reading comprehension
Auditory Processing Disorder	Difficulty hearing differences between sounds	Problems with reading, comprehension, language
Visual Processing Disorder	Difficulty interpreting visual information	Problems with reading, math, maps, charts, symbols, pictures

Specific learning disabilities

Comorbidity in learning disabilities





WHICH TOOLS FOR SUPPORTING LEARNING DIFFICULTIES

Learning sciences with learning disabilities

Dyslexic learners may excel in some aspects of the Sciences but experience great difficulty in others. In General Science classes, this may be puzzling for the teachers, since a dyslexic pupil's performance may vary according to the underlying scientific strands of different topics, resulting in inconsistent performance in the subject. While the possible strengths of dyslexic pupils and barriers to their attainment should be examined in this context of individual science subjects, there are some common elements that all science teachers should consider when constructing programmes of work.

(Dyslexia and Science Subjects, Moira Thomson - 2007)

THEORY AND PREPARATION
Additional barriers to learning –dyslexic pupils may:

- Fail to identify a diagram, table, chart or graph as an integral part of text
- Be unable to process information presented as tables, charts or graphs
- Spend so long drawing diagrams, tables, charts or graphs, that they fail to label accurately or enter any data
- Struggle to record information in a table, or transfer data to a chart or graph accurately
- Be unable to recall scientific vocabulary and terminology
- Struggle with scientific formulae that require a combination of upper and lower case letters, which are not interchangeable
- Have difficulty writing formulae where superscript or subscript numbers must be correctly positioned in order for it to make sense e.g. powers and indices
- Confuse the scientific meaning of terminology with other uses of this in the curriculum or in everyday life – e.g. 'conductor'
- Have difficulty understanding and remembering scientific symbols;
- Be unable to follow/remember a sequence of instructions
- Have difficulty assimilating abstract concepts
- Confuse similar words, resulting in misinterpretation of content and context

THEORY AND PREPARATION
Suggested support strategies

- Pair up a dyslexic pupil with a good reader as peer support
- Explain the role of diagrams, etc. in the text and teach how to create good diagrams with minimal written explanation
- Provide a full explanation of how to interpret each diagram, table, chart or graph in context
- Provide blanks tables, charts etc that are already labelled
- Always show and name lab equipment when giving instructions for its use
- Label all lab equipment cupboards with pictures as well as words - and do not move things around
- Put up posters and wall charts of lab equipment – use a picture/drawing + name
- Issue pupils with illustrations to help them remember scientific vocabulary and terminology
- Highlight key information/vocabulary and issue word lists of 'new' vocabulary for a new topic – in advance if possible
- Do not penalise spelling errors but explain and give examples to stress its importance e.g. word endings in Chemistry

THEORY AND PREPARATION
Suggested support strategies

- Revise and remind pupils of the need to use upper and lower case, sub and superscript in formulae – ICT use helps with this
- Help pupils to devise individual ways to ensure that they do not confuse upper and lower case, sub- and superscript in formulae
- Use a Maths or Science reference booklets to help with mathematical aspects of the science subject
- Issue a formula prompt sheet with colour coding or highlighting to stress upper and lower case, sub- and superscript in formulae
- Use ICT with word prompts to support word finding
- Do not ask dyslexic pupils to copy notes/diagrams – issue copies of these
- Do not ask dyslexic pupils to make notes while watching a demonstration or listening to instructions
- Allow pupils to record dictated notes so that they can store them as voice files for revision – or issue legible copies of these

PRACTICAL ACTIVITIES
Barriers to learning

- Have difficulty locating appropriate equipment
- Find holding a list of instructions in memory difficult
- Misunderstand complicated instructions
- Be unable to carry out a sequence of actions in the right order
- Take 3 to 4 times longer than classmates to complete the same activity
- Confuse directions - left/right or forward/back
- Have difficulty processing problems at the same rate as classmates
- Struggle to read scales and measurements
- Confuse similarly named equipment and substances and select the wrong item
- Have difficulty recording data when carrying out a practical task

PRACTICAL ACTIVITIES
Suggested support activities

- Pair a dyslexic pupil with a good reader as a safety precaution
- Set vocabulary learning/revision for homework – use word searches and a 'games' approach in class to revise
- Highlight names of equipment needed – use pictures as well as words
- Give only a few instructions at a time and repeat instructions frequently
- Encourage pupils to check each others' equipment set up for safety points – rewards for collecting these can be built in
- Design flow charts showing the sequence of steps in an activity;
- Number the steps in a practical activity and encourage checking these off once completed
- Use prompts and arrows to indicate directions
- Give help for reading scales
- Allow pupils to dictate results during an experiment
- Allow extra time for dyslexic pupils to carry out practical tasks, or set up their workstations in advance
- Permit the use of alternatives to writing when recording results – e.g. Dictaphone

ALTERNATIVE ARRANGEMENTS FOR ASSESSMENTS

- Linguistic support (reader, digital examination papers, scribe, transcription with correction)
- Extra time allowances
- Use of word processors with spellcheckers, specialised software and other technological aids
- Transcription without correction to remove illegibility
- Use of formula prompts and calculators where these are not generally available
- Rest periods/supervised breaks when the extra time makes the exam extremely long
- Adapted question papers for candidates who experience visual distortions

Checklist of key questions for inclusive practice - teaching and learning

Supporting STEM students with Dyslexia, 2013

- Do you provide clearly structured notes, covering the content in advance?
- Are these notes in sans-serif font with good line spacing and clear headings, avoiding small text and cramped layouts?
- Do the notes include clear definitions of all notation and terms used?
- Are these notes available in non-PDF format for screen-reader accessibility?
- Are all diagrams in notes, hand-outs, presentations, etc, clearly labelled and positioned so that there is a logical order with the related text?
- Are new technical words given visually, where possible, and a glossary provided?
- Is symbolic notation clearly written to avoid confusion with other characters?
- Are screenshots visible long enough to allow students to assimilate information?
- Do you avoid the need to copy complicated mathematics from the screen or board?
- Do data tables and spreadsheets have shaded or coloured columns to aid clarity?
- Are generic templates available to help structure written work, particularly for laboratory or field work?
- How have you assessed your competence standards in laboratory or field situations?

Checklist of key questions for inclusive practice - assessments

- Are the assessment tasks clearly set out so that students understand the requirements of the question and solution?
- Are formula booklets and/or a glossary of terms available in exams and tests, where competence standards allow?
- Is coloured graph paper or squared paper available in exams?
- Do questions avoid rote learning and recall by focusing on understanding?
- Do you have a marking scheme that avoids penalising messy work?
- Do you provide alternative assessments (e.g. presentations/posters/portfolio of work/annotated diagrams instead of written work)?
- Is detailed and clear feedback, available in alternative formats, given to enable students to see how to move forward?
- Have you reviewed all of your tests for accessibility?

HAVE MOST OF OUR STUDENTS LEARNING DISORDER IN LEARNING PHYSICS?

- Difficulty to recognize math writings
- Remember how to write formulas confusing variables order and position
- Troubles to predict a phenomenological behaviour or simply to describe it
- remember the order of instructions and procedures for problem-solving
- difficult in remember the right words to tell something about physics description
- difficult in memorizing sequences to derive a physical law
- difficulties in organizing their studies

ATTITUDES TOWARDS PHYSICS LEARNING…

- frustrated
- hungry
- sad
- inadequate
- hide difficulties

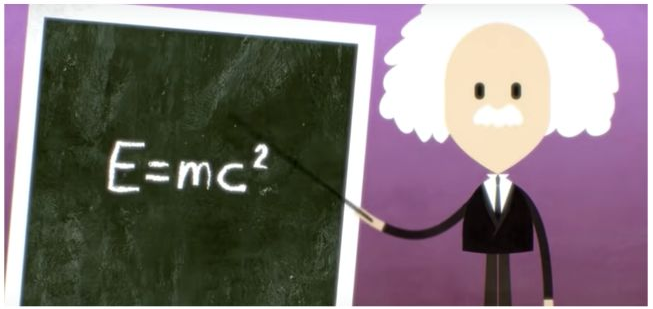
THINKING A DIFFERENT WAY OF TEACHING

To find different ways for presenting and resolving problems

to narrate and tell in more detailed descriptions of facts and observations

To emphasize how something works

and then inventing, drawing, painting, making things…

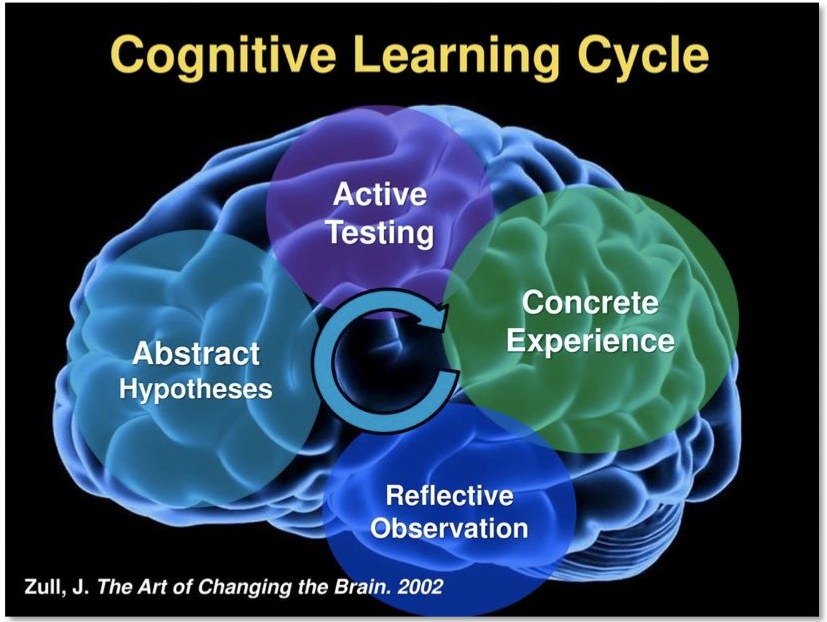


PHYSICS TEACHING APPROACH

If students have all these difficulties how could we change our physics teaching approach in order to support their learning and treat their disorder?

Are students' cognitive difficulties a consequence of our teaching methods and approaches?

Have we really engaged our students in a complete cognitive learning cycle as Zull suggested to improve a meaningful learning?



VYTAUTAS MAGNUS UNIVERSITY

TRANSFORM 4EUROPE

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Including Students with Learning Disabilities in Physics Higher Education

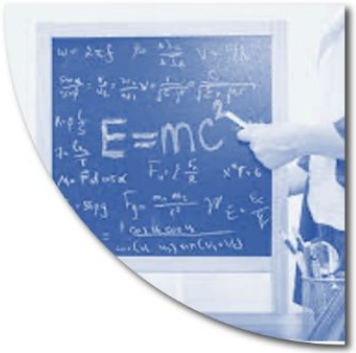
GOALS

ACCOMODATION

Are our universities ready to accommodate students who have specific learning disorders?

UNIVERSAL DESIGN

Are they careful in how classes are conducted, how exams are organized, and is any material provided to support students?



RESOURCES FOR TEACHERS

Is care taken that the teaching processes promote learning in students who wish to take college courses and who present difficulties?

TEACHERS

STUDENTS

There are about 200 students with Learning Disabilities attending courses at Univeristy of Trieste

FACULTY AWARNESS

Faculty members can be made aware of the characteristics of specific learning disabilities. Such awareness thus provides a theoretical frame of reference that makes it possible to know at least in general terms the most characteristic learning problems of students with Learning disabilities.
In parallel, pathways can be activated to investigate well-being and difficulties of students already enrolled in university courses.

PROFESSIONAL DEVELOPMENT

TUTORING

4 TRANSFORM

VADEMECUM FOR PHYSICS TEACHING

SUPPORTING

...becoming an inclusive University...

...enacting facutly's reflection...

...promoting students' wellness...

PHYSICS TEACHING

ACTIONS FOR INCLUSIONS

It shall involve in supporting actions all the teachers coming from every subject area. This is to ensure that an inclusive policy is characterizing the university and not just individual disciplinary and subject areas. In this direction, it is desirable to produce a document ("vademecum") that guides the actions of faculty members in accompanying and supporting Learning Disabilities students.

...targeting the need to change...

...promoting research through multidisciplinalrity perspectives...

RESEARCH FOR TEACHING

One may wonder whether there are teaching strategies that better meet the learning needs peculiar to Learning Disorders. To answer this question, it is necessary to promote research in teaching in order first to foster the study and then the dissemination of good practices that promote the learning of students with Learning Disorder through all the steps of the teaching.

...ensuring formative success...

...creating research opportunity...

PHYSICS EDUCATION RESEARCH

Physics Education Research is deeply devoted in the studies of teaching College Physics: what about Italian univeristy courses?

Is there an approach which supports students with Learning Disabilites?

1) Analysing research experiences
2) Promoting faculty's reflections
3) Planning for future actions
4) Collecting information by students' experiences
5) Planning resources and time

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