Supporting Students with Learning Disabilities in STEM Education: Implications for Inclusive Education

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Context

- Researchers have demonstrated the efficacy of inquiry-based science interventions for students with learning disabilities. (Therrien, Taylor, Hosp, Kaldenberg, & Gorsh, 2011).
- Unfortunately, however, only a small proportion of students with LD tend to pursue STEM disciplines in postsecondary education.
- Individuals with learning disabilities (LD) are thought to have at least average intelligence (or above) (Learning Disabilities Association of America, 2017).
- However, students with LD tend to perform academically at levels that are significantly below what one would expect given their intellectual or cognitive potential.

Learning Disabilities (LD)

LD is defined as “a number of disorders which may affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information.” (LDAC, 2002, 2015, p.1).

According to the Learning Disabilities Association of Canada (LDAC, 2002, 2015), learning disabilities are thought to be due to genetic and/or neurobiological factors that significantly impact cognitive processes that are related to learning.

Learning Disabilities include:
- Language processing
- Phonological processing
- Visual spatial processing
- Processing speed
- Memory and attention
- Executive functions (e.g., planning and decision-making).” (LDAC, 2002; 2015, p.3).

- Learning disabilities may affect the attainment and function of an individual’s:
  - oral language
  - reading
  - written language
  - mathematics abilities
  - organizational skills
  - social interaction
  - perspective taking

Cognitive Processing Issues and STEM Learning

- Cognitive processing deficits might negatively affect students’ learning and achievement in science.
- The number of students with LD are increasing in general science classrooms, but they continue to underperform in STEM subjects because of their cognitive impediments.
- Unfortunately, there is a dearth of research on cognitive processing issues in relation to understanding and engaging with scientific tasks.

It is essential to understand these issues to develop scaffolded learning environments for special needs students.

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Issues Faced by Students with LD in Science

- Reading science texts and writing
- Gleaning salient information from lectures and presentations
- Participating in group work
- Following instructions to carry out scientific experiments
- Dealing with mathematical tools and numeric data in science.
- Problems with acquiring, retaining and recalling information relevant to the learning task
- Attention deficits, low self-esteem, and behavioral issues (Brigham et al., 2011; Elbaum & Vaughn, 2003; Scraggs & Mastropieri, 1993; Scraggs, Mastropieri & Boon, 1998; Swanson & Saez, 2003)

Supporting Students with LD in STEM

- Professional development of science/STEM teachers
- Minimize working memory load through external representations and memory aids
- Developing differentiated strategies to support students with LD

Barriers to the Inclusion of Students with LD in Science

Students with LD who struggle with reading, writing, or mathematical reasoning confront multiple daunting challenges as they engage with problem-based STEM tasks.

- Special needs students are not receiving appropriate supports in science classrooms.
- K-12 teachers lack training & professional development to support students with LD in science classrooms.
- Teachers lack appropriate resources and receive little support from administrators for inclusive settings.

Use symbols and objects

- Graphic organizers
- Concept maps
- 3D models
- Simulations
- Pictures
- Diagrams