



Experiential and Experimental Learning for Visually Impaired Students:

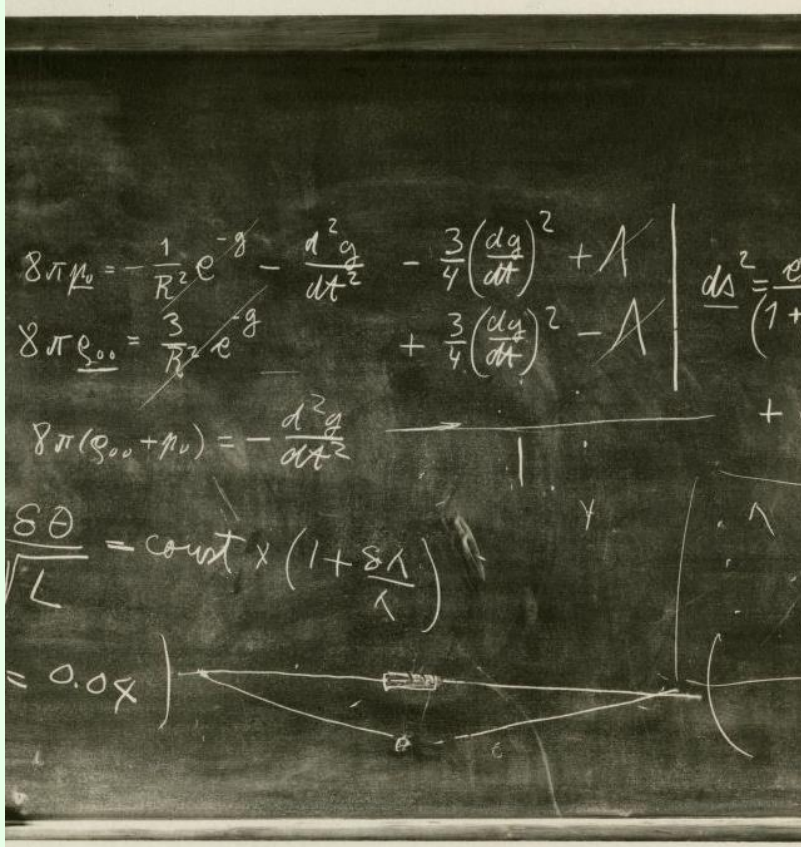
A Bibliographical Review for Differentiated Instruction

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The Challenge of STEM Subjects



The Visual Barrier

Traditional STEM subjects like Physics and Biology are highly visual. Students with Visual Impairments (VI) often face a **risk of exclusion**, becoming passive observers rather than active participants.



Key point

The goal is a pedagogical shift: moving from 'reading about science' to 'doing science' through alternative sensory channels.

Differentiated Instruction (DI)

THEORETICAL FRAMEWORK

Based on Carol Ann Tomlinson's principles, we can differentiate by:

- **Process:** Modifying how students interact with ideas through tactile tasks.
- **Product:** Allowing students to demonstrate knowledge via non-visual outputs.



Aims of This Review

This presentation maps literature on how experimental learning promotes inclusion.



Cognitive Benefits -
Mapping the advantages
of hands-on inquiry.



Accessible Tools -
Reviewing lab equipment
and assistive technology.



Social Inclusion -
Proposing collaborative
classroom strategies.

Methodology

We conducted a systematic review using **Scopus**, **ERIC**, and **Google Scholar**.

Our focus was specifically on **inclusive, general education classrooms** rather than segregated settings.

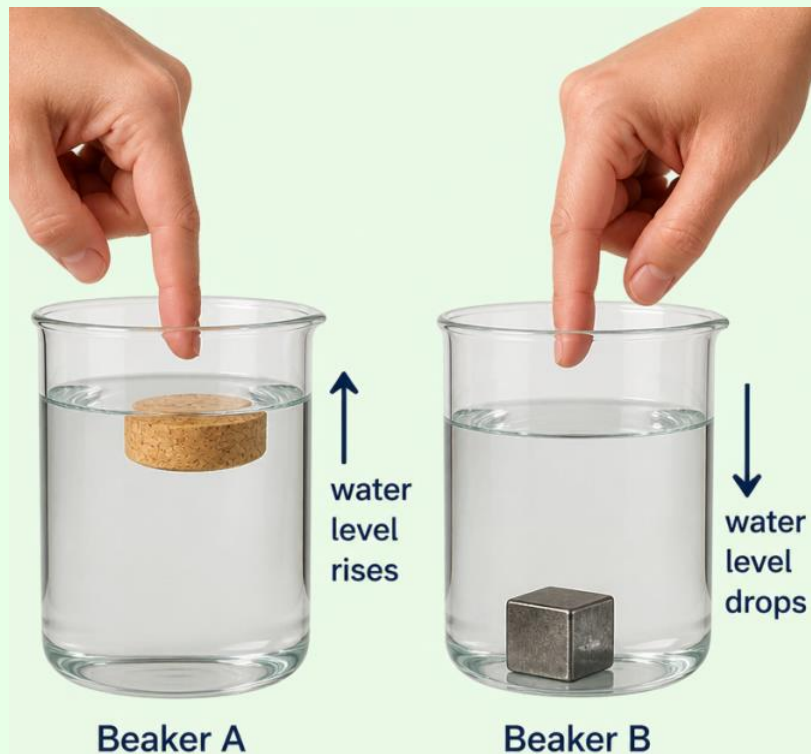


Example

Keywords used: Visual Impairment, Inquiry-Based Learning, Experimental Science.



Cognitive Benefits



From Abstract to Concrete

Experimental learning translates concepts like *density* or *thermal expansion* into tactile realities. This helps VI students build **accurate spatial mental models**.



Remember

Direct physical interaction is the bridge between a theoretical formula and a scientific understanding.

Psychosocial Impact

AGENCY & AUTONOMY

Active participation fosters the feeling of

"I can do it myself."

It shifts a student's identity from a 'passive recipient' to an **'active contributor'** to their team.



Assistive Tools in the Lab

Material differentiation uses tools to convert data into non-visual formats.



Auditory Tools - Light-to-sound probes and audio pH indicators.



Talking Tech - Thermometers and digital scales with speech output.



Tactile Support - Raised-line rulers and notched measuring syringes.

The Cooperative Approach



Peer-Mediated Learning

In heterogeneous groups, tasks are distributed based on abilities. VI students can take active roles:

- **Data Manager:** Recording results via screen readers.
- **Director:** Managing the protocol steps.

The Evolving Role of Educators

Teachers should move away from being 'velcro-assistants' who do the task for the student.

Instead, they must be **facilitators of independent exploration** through proactive design.

Fun fact

Universal Design for Learning (UDL) benefits all students, not just those with impairments.



Identified Barriers

Structural Barriers

- Lack of specialized, adaptive equipment and facility accessibility.
- Safety concerns and student anxiety regarding physical risks.
- Significant training deficits and lack of PD for instructors.

Identified Barriers



Structural Barriers





Lack of accessible equipment.



Safety concerns/ anxiety.

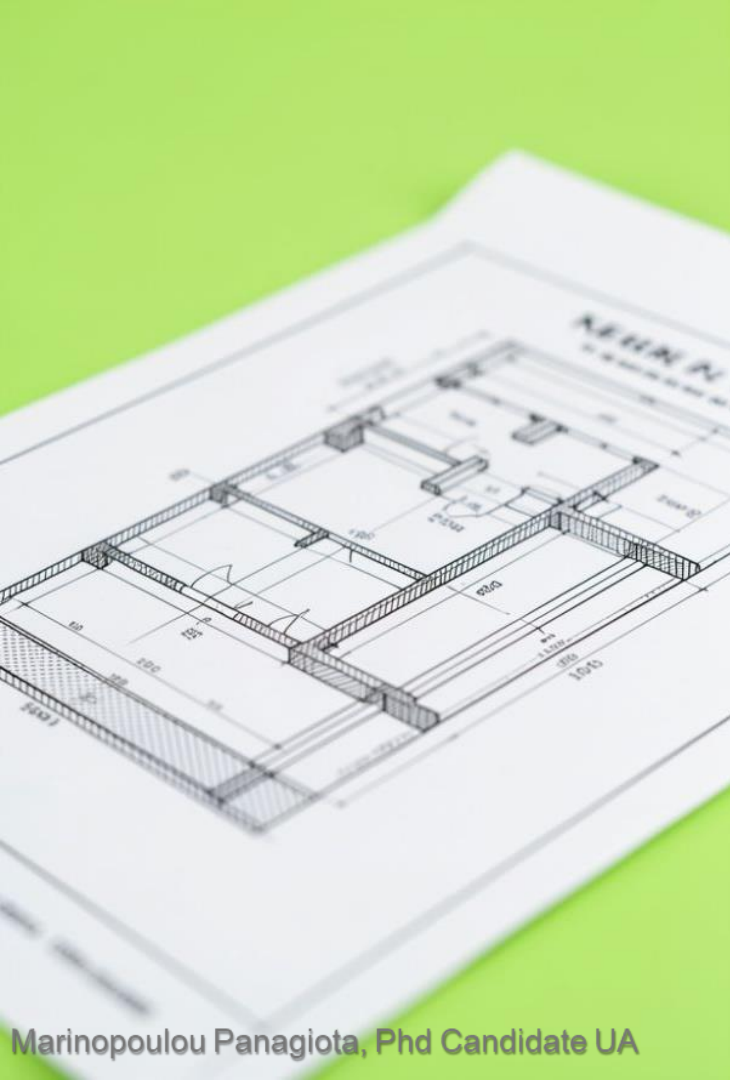


Training deficits in teachers.



Low-Cost Adaptations

When high-tech is missing, use everyday materials. Different **textures, weights, or physical shapes** can substitute for visual markers in experiments.



Future Directions (PhD)

This framework serves as the foundation for my doctoral thesis.

I will move into **empirical application**, testing how mixed-ability classrooms in local contexts respond to these differentiated activities.

Critical Reflection



If you were a science teacher, how would you modify a basic liquid-mixing experiment for a visually impaired student without using any digital technology?

Conclusion

Inclusion is a practice, not just a policy. By providing Equity over Equality, we ensure all students enjoy the same cognitive rights.

The Differentiated Classroom. — Carol Ann Tomlinson

Thank you for your attention!

