Assistive Technology Interventions for Adolescents and Adults with Learning Disabilities

An Evidence-Based Systematic Review and Meta-Analysis

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Objectives

An increasing amount of **assistive technology** (AT) interventions exist for adolescents and adults with **learning disabilities** (LD). The aims of this review were to:

1. survey **both quantitative and qualitative** research, to determine
   - whether interventions are effective
   - how they affect lived experience
2. formally assess the **quality** of available studies

Methods

Literature search:

1. PubMed queries
2. Google Scholar (2 methods)
3. ERIC
4. Citations of related reviews
5. Recent articles of related journals

We located:

- 32 quantitative intervention studies
- 11 qualitative studies
- 5 survey studies

Almost all conducted in educational settings.

Quality assessment:

- Using a modified Downs-Black checklist (Justice et al., 2008)
- 2 independent raters (BP, KRG)
- Intraclass correlation coefficient for average rating scores = 0.874
- Consensus ratings were produced

Intervention Studies

We sorted intervention studies **by topic**:

1.	Text-to-speech systems	10 publications
2.	Speech-to-text systems	6 publications
3.	Word processing	5 publications
4.	Multimedia & hypertext	4 publications
5.	Smart pens	4 publications
6.	Other computer-based	3 publications

We performed **meta-analyses by topic group** where possible (reasonable study quality scores, comparable outcomes...)

Qualitative Studies

Qualitative studies were also sorted **by topic** (listed **from general to specific**):

1. AT as one component of accommodations: 4 publications
2. Perspectives about AT: 1 publication
3. Technological course supports: 4 publications
4. Specific assistive supports: 2 publications

We created a **qualitative summary**. Some points:

- Students did not necessarily like or use institution-provided AT
- Regular AT users often set up their AT using their own resources
- Customization is very important
- Negative emotions connected to:
  - Technical difficulties
  - Insufficient support
  - AT use perceived as stigmatizing
- Non-self-reported and self-reported data similar → asking AT users often easiest!

Meta-analyses of Intervention Studies

Text-to-speech: Reading comprehension as outcome variable. Small overall effect ($g = 0.445, p = 0.06$) that further diminishes if the outlier is excluded. Some evidence that interactions obscure the effect: higher initial reading skills lead to more negative outcomes. AT can be distracting!

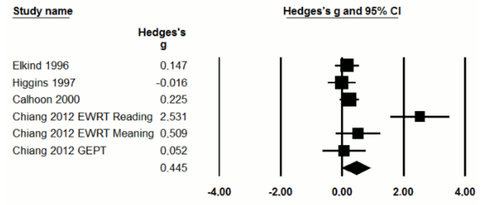

Figure 1: Forest plot for text-to-speech systems

Speech-to-text: Generally positive results, but outcome variables too different for meta-analysis despite similar hardware & design across studies

Multimedia & hypertext: Effects tended to be positive, but both large confidence intervals in many studies and considerable differences in intervention design → we opted not to do a meta-analysis

Word processing: Error rate change as outcome variable (negative is better).
Large effect ($g = -1.626, p = 0.002$)

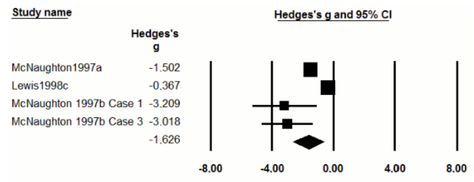

Figure 2: Forest plot for word processing systems

Smart pens: Reading comprehension as outcome variable. Small, but significant positive effect ($g = 0.449, p = 0.029$)

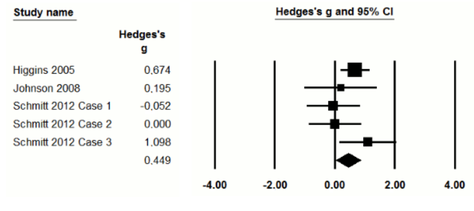

Figure 3: Forest plot for smart pen interventions

Survey Studies

Limited conclusions due to:

- Small amount of studies despite ease of access (through disability services)
- Only 2 studies w. quantitative evaluation
- Data from different countries
- Data not cumulative, distinct topics:
  - Different technology use profile from ADHD / TD
  - AT use related to more hopeful outlook

Conclusion

Convergent results from both quantitative and qualitative data: AT supports **can be effective, but they need to be customized** to the person. Some forms of AT **can be unhelpful or harmful** for some participants. Word processor interventions like spell and grammar checking were most effective. Methods varied considerably; in the future it would be important to use **comparable designs and similar outcome variables** across studies. Study quality was comparable to research on other interventions (Justice et al., 2008).

References

Justice, L. M., Nye, C., Schwarz, J., McGinty, A., & Rivera, A. (2008). Methodological quality of intervention research in speech–language pathology: Analysis of 10 years of group-design studies. *Evidence-Based Communication Assessment and Intervention*, 2, 46–59.

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