Expanding Writing Assessment to Include Technology in Individuals with Aphasia

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Learner Outcomes

1. The participant will identify 3 ways to evaluate keyboard writing in individuals with aphasia.
2. The participant will demonstrate ability to use word prediction in an assessment process with individuals with aphasia.
3. The participant will recognize types of aphasia that are better candidates for writing with technology (keyboarding).
Rehabilitation of writing recovery…

- is often the least explored of all aphasia service delivery
- using technology has been even more limited
- requires improved techniques in the assessment of the potential of writing with technology.
Current testing materials for aphasia with agraphia

Formal tests include pen/paper assessment only
Subtests of Western Aphasia Battery- Rev. (Kertesz, 2007)

- Writing alphabet and numbers
- Writing dictated letters and numbers
- Word level writing to dictation (based on 6 words of increasing length “gun”..“watch”..”screwdriver”)
- Or task can be confrontation writing given object
- Dictated sentence “pack my box…”
- Copied sentence
- Picture description (score for 6+word sentences, deduct spelling and paraphasic errors)
Comprehensive Aphasia Test (CAT) (Swinburn, Porter, Howard, 2005)

- Copied
- Confrontation to pictures
- Dictated
- Picture description
Subtests of Boston Diagnostic Aphasia Exam-3
(Goodglass, Kaplan, Barresi 2001)

- Alphabet and numbers 1-10
- Dictated letters, abbreviations
- Copy “quick brown fox…” sentence cursive and printed (p. 35 Record Booklet)
BDAE-3 continued

- Word level writing to dictation
  - Primer vocab
  - Regular spelling words (“apartment”)
  - Irregular spelling words (“knife”)
  - Uncommon irregularities (“reign”, “yacht”)
  - Nonsense spelling – reveals spelling knowledge

- Oral spelling

- Word level confrontation writing
  - Objects
  - Actions
  - Animals

Word level parts of speech, verbs, etc
BDAE-3 continued

- Dictated 3-5 word sentences –functor loaded ("He cannot do it")
- Picture description of “Cookie Theft” scored for (p. 36 Record Booklet):
  - Mechanics
  - Written Vocabulary Access
  - Syntax
  - Adequacy of Content
  - Qualitative comments
Multilingual Aphasia Examination- 3rd ed
(Benton, deS. Hamsher & Sivan 1978)

- Word level
  - Dictated
  - Oral spelling
  - Manipulative physical letters

- Rating form for writing on legibility and letter formation
Examining for Aphasia- 4th ed
(La Pointe & Eisenson, 2008)

- Not available for review
Subtests of Assessment of Language-Related Functional Activities (ALFA) (Baines, Martin & McMartin Heeringa, 1999)

- Writing of daily activity tasks-
  - Writing a check
  - Taking a phone message
  - Addressing an envelope
These aphasia assessments do not....

- Evaluate potential for writing with technology
- Determine strengths and weakness in keyboarding
- Compare handwriting to keyboarding for communicative success
- Evaluate the interest or personal experience in writing tasks or formats
In area of student writing

- Assistive Technology Assessment: Developing a Written Productivity Profile by Denise DeCoste (2005)
  - protocol for determining keyboarding potential and compared potentials between writing and keyboarding

• The student assessment can be used in part for adults with aphasia... but truly a new protocol needs to be utilized

• This presentation is part of pilot project to create a Written Profile Assessment that includes Keyboarding/Technology
NOTE:

- For purposes of this presentation, discussion of using voice recognition software to “write” is not included.
- The ability to write with a pen or keyboard implies an ability to generate spelling and visual construction of orthographic display.
Dominant hand weakness

- Injury to left hemisphere (particularly with frontal lobe involvement) co-existing right hemiparesis or weakness may occur.
- One clinical strategy had been to encourage the individual to write with the left hand and switch to right hand as the strength returned, or use adaptive writing tool.
A study of 21 normal adults aged 20-56 with switched hand in writing ("cross-handed trained") indicated legibility decreased as comfort and speed increased,

but improvements noted with training performance of either hand (Walker & Henneberg 2007).
• Process of handwriting with non-dominant hand can be slow
• No data comparing cross handed training of people with aphasia to those without neuro injuries
• Suspect that process slower than in normals
One pilot study of use of non-dominant hand due to injury of dominant limb-involved 12 adults primarily limb amputations (Yancosek & Mullineaux, 2011).

Findings revealed variability among participant performance increased as the task demands increased...

“between-subject variability expressed itself in unique writing styles, which suggests an idiosyncratic nature of handwriting”
• Very little research has compared quality of written outcome with non-dominant hand writing compared to keyboarding post stroke (Alexander et al. 1992; Valenstein & Heilman, 1979; Levine et al 1988)

• But most of these studies were before current software availability, i.e. word prediction, and in an age where computers were not a standard feature in the home
• Individuals with apraxic dysgraphia will display more difficulty with handwriting (Ball, 1998), as the problem has a motoric component

• therefore, these are good candidates for keyboarding assessment
Example of mixed agraphia- (motoric/ apraxic/ attention error) which was self-corrected with only prompt to “try to correct”.

A.O. left frontal parietal hematoma, post craniotomy

- Target “woman is brushing hair”
With the availability of keyboarding and touch screen computers, the issue of motor problems can be resolved and the treatment quickly directed to linguistic ability.
The increase in number of individuals who include computers in their lifestyles provides us with a necessity to include assessment and treatment with keyboarding (Dietz, Ball, & Griffith, 2011).
Background Studies on using technology in writing rehabilitation specific to aphasia

Early research showed emphasis on using technology to improve functional handwriting.

Authors did not discuss keyboarding as an alternative to handwriting.

The upcoming review is presented chronologically of publication date.
Seron, Deloche, Moulard & Rousselle (1980)

- 5 individuals with aphasia and agraphia
- Typewriter keyboard with visual display of letter boxes
- Early spell check system with auditory buzzer that sounded when incorrect letter
- If errors occurs, the word was typed again
- Task of words from dictation
Seron et al. (1980) Conclusions:

- “the framing of the words… and appropriate letter positioning seem to have a positive role in the control of writing activity” p. 56

- “program observed in our patients’ handwriting indicates, however, at least a partial transfer of learning between typewriting and handwriting performance” p. 57
• Next researchers shifted in using features of technology to create and edit the text production
• No longer a goal to handwrite as computers becoming more socially acceptable
King & Hux 1995

case of mild non-fluent aphasia and AOS

Program of Write: Outloud™ to “edit”
samples previously dictated to a clinician.

- Used text reader feature to hear his productions and then edit
- Used spell check feature to edit
- Identified errors
- Received cues from clinician
Research on word prompt or word prediction programs as software began to develop.

See Wood, Rankin, Beukelman’s (1997) article on uses of word prompt programs such as “(Co:Writer, EZ Keys, HandiWORD, Telepathic II, Write Away)”
Murray & Karcher (2000)

- Case study of individual with moderate Wernicke’s aphasia
- Word prompt software Co:Writer but did not use auditory feedback feature
- Included cueing hierarchy
- Target of Verbs and SVO sentences
Murray & Karcher’s Conclusions

- Qualitative progress noted with trained material
- No generalization to untrained verbs
- Error types became more word related over time

“a treatment that incorporated cueing hierarchy, word prompt software and sentence construction abilities resulted in substantial improvements in written verb retrieval and sentence construction..” p., 598
Armstrong and MacDonald (2000)

- Case study with non-fluent aphasia
- Use of lexical and grammatical prediction (Co:Writer®) and synthesized auditory feedback (Write:OutLoud® program).
- Provided evidence of more normal written output at the word and sentence levels
- Improved spelling of irregular and exception words
• identified problem with program... if selects wrong letter, will prompt wrong sets of words, but doesn’t advise how to deal with
Mortley, Enderby & Petheram (2001)
• Case study of individual with severe writing deficit, yet able to copy
• Tasks of independent practice with computer software: INTACT (1996)
• Computer used for feedback to give choice letters when error occurred
• Sentence copying tasks
“it was therefore decided to introduce an adaptive word processor in the hope that his writing would become more functional. … designed to speed up the process of writing.“ (p.453)

The description is one of early word prompt.

The program was “motivating” due to the “hi-tech” feel (p. 460)
• Devices begin to shift in portability, as with Lightwriter

- Single case study of individual with jargon aphasia showed orthographic access with handwriting limited ability
- Treatment with Lightwriter involved “anagram, copy, delayed copy and picture naming” (p. 772)
- Lightwriter used for home practice with delayed copying and naming tasks
- Recognition of errors and opportunity for self-correction given
- Cues of initial letter, number of letter, initial vowel etc. were provided
Behrns, Hartelius & Wenglin (2009)

- Study with 3 individuals with no more than mild-moderate aphasia
- Writing aides- word prediction (Saida) and spell checker
Behrns et al. (2009) conclusions

- Improvements were not attributed to the computer aides alone
- “Motivation probably partly explains why the computerised training was reported as very positive”
- “it is most likely important to have good reading comprehension in order to use the writing aids used in this study”

(p. 1291)
None of these previous studies had implemented any assessment protocol for making decisions on type of technology to trial with the client.

Clinically that seems that we are working backwards...
This current presentation recommends a procedural approach to collecting information about the client’s abilities and potentials PRIOR to initiating treatment with technology and writing.
Outline of protocol

- Begin with questionnaire
- Test basic reading and cognitive skills
- Visual skills
- Motor skills
- Linguistic
- Recognition and Self-correction skills
- Ability to use word prompt functionally
Pilot data has shown that a degree of cognitive ability and reading comprehension is needed for individuals with aphasia in order to use word prediction.

Therefore, cognitive assessment is highly recommended.

(Ball, Grether, Garza & Romich, 2009; Ball, Grether & Thompson, 2006)
Reading tasks

- Determine if any difficulty with graphemic form: can match letters of different font?
- At least word level comprehension should be functional-
- BDAE-3 only test includes matching of font, homophones, etc.
- *Reading Comprehension for Aphasia-2* (RCBA-2) is excellent tool for more in-depth analysis
Suggested cognitive tasks with visual component

- Raven’s Coloured Progressive Matrices - at least pass 6/12 of first set
- Cognitive Linguistic Quick Test (CLQT) Subtest for Visual recognition memory task - At least recall 5/6
Visual skills

- Evidence of visual field neglect?
- Any visual limitations - cataracts, glaucoma, - need for lenses?

1. Letter scanning
2. Letter selection accuracy
3. Eye tracking from keyboard to screen
4. Size of font
5. Need for visual contrast
Motor skills

- Premorbid keyboard use
- Use of one or two hands
- Speed in keyboarding
- Is adaptive keyboard necessary?
Keyboard adaptations

- Qwerty keyboard
- Adaptive letter keyboard
- Keyguards for motoric issues
Or will the future shift be away from keyboard.. And move to touch typing?

- Can individual visually and tactilely manipulate touch screen
- Determination of size—i.e. Ipad vs Iphone touch sizes.
- What is sensitivity of screen to touch?
Monitor adaptations

- All computers now have accessibility features
- Go to Control Panel….
  - Accessibility options
FONT

- Style
  - Berlin Sans FB
  - Comic Sans MS
  - Bell MT
  - Gill Sans MT

- Degree of Bold
  - Bold
  - BOLD
  - BOLD
  - BOLD

- SIZE
  - SIZE
  - SIZE
  - SIZE
Copying skills

- Test if able to type
  - Letters - individual
  - Letters - nonsense syllables
  - Words with visual – full word model
    - Phonetically spelled (regular words)
    - Non-phonetically spelled (irregular words)
  - Phrases of increasing length
Writing to Confrontation Naming

- Is client able to type words to picture
  - Regular vs irregular spellings

- Type words to dictation
  - Regular vs irregular spellings

- John Hopkins Dysgraphia Battery provides word lists (published in Appendix of Chapey’s text)
Recognition of own errors

- Does client recognize if word misspelled as she writes?
- If so, can she be cued to self-correct?
- If she can identify the section in error, remove wrong letters and try again with fill in, i.e. T__BLE and use a letter chart (in this example show vowels)
- Hierarchy cues
Writing phrases... sentences

- Can client generate logical and meaningful sentences?
- If not, can she recognize the error in the phrase or sentence?
- Can she repair?
- Look at the most complex syntactic form—what is present?
Recognition and Repair

- Ability to attend to the word typed on the screen, and then recognize an error is critical for the decision to backspace and correct.

- Individuals with attention issues and/or impulsivity may have more difficulty.

- Individuals with poor spelling abilities may “try out” letters, and retype often. The degree of ability to make decision on what to “try out” is critical on outcome.
  - (Ball et al. 2006 & 2009)
Try word prediction

- Can initial letter or letters be generated without cueing?
- Does the clinician need to provide hierarchical cues to initiate spelling? (see next slide)
- Once initial letter or letters generated, can client scan choices for possible word?
Example of improved communication ability for Participant 1 with sentence generation (stimuli BDAE-3 objects/actions).

Picture target = hanger

__________________________________________________________________________________________

Pre-testing with WP: It a fa .

Post-testing without WP: I hanger my clothes.

Example from (Thompson, 2005)
Example of case with expanded syntactic complexity and length of sentences

Pre-test MS Word: “dog girl r- -”
Post-test with Co:Writer: “A bark is sharp she is a dog.”

Pre-test MS Word: “dad girl car tree”
Post-test with Co:Writer: “She is car going things for drive.”

Target concept: The father is asking the daughter ‘who is driving?’

(Ball, Thompson, Grether 2006)
Cueing hierarchy - clinician generated

- phonemic cue (starts with /k/)
- auditory information of grapheme (it’s the letter k)
- visual letter choice
  - all alphabet
  - isolated row
- visual letter (pointed to letter on board)
Skills of better candidates for Word prediction keyboarding

- Functional reading, even at sentence level
- Auditory comprehension
- Verbal letter naming
- Able to work independently
- Apraxic component to agraphia

(Ball, Grether, & Thompson, 2006)
Some client variables that may contribute to limitations with WP

- Low auditory comprehension (i.e., score of 2/6 on BDAE short form).
- Fatigue or frustration (the participant in Ball, Thompson & Grether, 2006 was “challenging” himself to try without the cues and did not benefit)
- Unable to input the correct first letter(s) of a word and, therefore, the program generates a word list unrelated to the word the participant was targeting
- Relying too heavily on the generated word choices and lost the original intent of his message (e.g., *The[se have you for the new and easy person with you]*)
Example of case with unsuccessful revisions to write the targeted word with WP

Example target word BROOM:

\[
\begin{align*}
\text{pot} & \rightarrow \text{be} \rightarrow \text{bom} \rightarrow \text{bon} \rightarrow \text{bogg} \rightarrow \text{bog} \rightarrow \text{boe} \rightarrow \text{bow} \\
\text{w} & \rightarrow \text{bow} \rightarrow \text{bod} \rightarrow \text{bog} \rightarrow \text{boh} \rightarrow \text{borr}.
\end{align*}
\]
Programs with word prediction software

- Co:Writer  Don Johnston Co.
- Saida
Product information

• Lightwriter: Available at tobii.com
References


