

The Cognitive Demands Checklist → *Thinking about Thinking for AAC*

An interactive online source designed to provide summaries from literature in fields of AAC and cognition.



Introduction

Challenge: To date limited discussion and research about the cognitive skills demanded of user for AAC technologies.

Goal: To develop a literature resource to help describe the cognitive demands that various features of AAC devices or apps place on the person with complex communication needs

Targeted Users: AAC clinicians and device developers

Current Efforts: Year 5 of the RERC on AAC.



Value statements

All humans are learners.

Individuals have unique learning styles.

Learning to communicate is a basic human right.



What *Thinking about Thinking for AAC* is

A tool to answer: "What does this device or app demand cognitively from the user?"

- Provide literature references about the cognitive demands of specific features of AAC technologies
- Provide opportunity for clinicians to consider and compare the cognitive demands of AAC technologies
- Identify available research gaps that exists regarding the cognitive demands of AAC technologies and apps to guide future directions
- Inform the design of AAC technologies

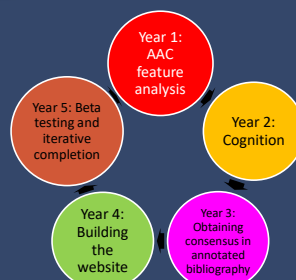


What *Thinking about Thinking for AAC* is NOT

- **NOT** an assessment tool.
- **NOT** a prerequisite list of cognitive skills needed before AAC technology is introduced.
- **NOT** a list to determine eligibility for potential device trial, purchase or training.
- **NOT** a list of cognitive skills needed before trialing or purchase.
- **NOT** a base to eliminate AAC options for individuals who may rely on AAC technologies.

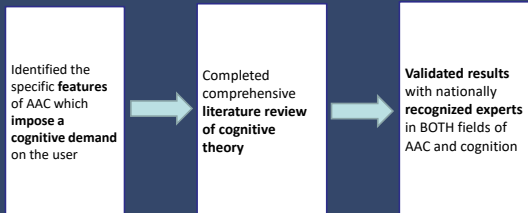


Five Year RERC on AAC project based on the KT4TT Stage Gate Model



Development Process

Where to start?



Cognition

- The human mental processes of acquiring, using and understanding knowledge.
- There are many domains that are used to describe these thought processes.
- The *Thinking about Thinking for AAC* examines three cognitive domains:
 - Attention
 - Memory
 - Executive function



Cognition Resources

- NIH Toolbox- Cognitive measures
- Weschler Adult Intelligence Scale-5
- Cattell-Horn-Carroll theory on the structure of human cognitive abilities (CHC)
- Lezak's Neuropsychological Assessment
- Theoretical approaches to cognitive rehabilitation
- Baddeley's model of working memory
- Educational and developmental theory
- Instructional design
- Human-computer interface



Attention

Attention is generally defined as a system of cognitive processes including:

- **Sustained** attention, the ability to maintain attention to task
- **Selective** attention, ability to maintain focus while filtering out distractions
- **Alternating** attention, ability to switch focus between tasks
- **Divided** attention, the ability to process or attend to two different demands simultaneously.

Examples of attention demands for AAC

- *The user must focus on a cursor as it moves from box to box on a grid for auto scanning.*
- *The user must attend to the accuracy of a selection while typing an intended message on the keyboard.*



Memory

Memory is the ability to take in information, encode it, store it, and retrieve it at a later time.

Examples of memory demands for AAC

The user must retain the intended phrase-length message while generating the message word by word.

The user must remember the content and location of stored messages with a dynamic multilevel display.



Executive Function

Executive function refers to a set of complex, higher order processes involved in the planning, organization, regulation, and monitoring of goal-directed behavior.

Example of an executive function demand for AAC

The user must

1. *initiate navigation through multiple pages*
2. *choose the most efficient navigation path*
3. *monitor performance & correct errors*
4. *locate and select the target symbol with in a dynamic multi-level display*



AAC SGD Feature matching resources

- AAC Device Assistant (AAC TechConnect, 2012)
- AAC Feature Match Checklist (Harris, Ryder, & Totten, 2010)
- Feature Match Comparison Chart (Oklahoma Assistive Technology Center, 2013)
- Rocky Bay (Positive AACtion Information Kit 2010)
- Select pages from Feature Match Checklist (Marfilus & Fonner 2012)



AAC App Resources

- AAC Apps Feature Comparison (Crawford & Watson, 2011)
- Feature Matching Communication Applications (Gosnell, 2011)
- iPad Apps for Complex Communication Support Needs: Augmentative and Alternative Communication (CALL Scotland, 2015)
- Quick Feature Matching Checklist (Beady, 2014)
- Rubric for Evaluating the Language of Apps for AAC: RELAAACs (Parker & Zangari, 2012)
- Select pages from Feature Match Checklist (Marfilus & Fonner 2012)



AAC features with cognitive demands

- 43 app or device features identified to have a cognitive demand
- Did not include features that have an operational demand only
- Features organized into four categories
 - Access (n= 7)
 - Language (n= 17)
 - Display (n= 11)
 - Output (n= 8)



Making the annotated bibliography

Literature review:

Key words: Attention, memory or executive function + *designated feature*.
i.e.: *Memory + direct selection for AAC*

Recent evidence rule: within past ten years UNLESS sentinel article

Consensus:

Articles read independently by at least two team members, annotating relevant citations; relevance then verified

Annotated bibliography:

Added reference and summary to database to make information easily accessible to clinicians



Thinking about Thinking for AAC: Two Parts

Part One: An online interactive library

Thinking about Thinking for AAC [Home](#) [Go to Library](#) [Learn More](#) [Log In](#)

Library Information

Select the features of the AAC technology and click 'Submit' to view a report of the associated cognitive demands.

Please note: The Cognitive Demands Report may be missing information about the cognitive demands of some of your selected features due to a lack of research literature about those features. If no information is available about a given feature, "No References Found" will appear in the report.

[Expand All](#)

Access
The means by which the user makes selections on the device or software.

Language
Refers to the vocabulary available on the device or software, and may include text, images, or a combination of both.

Display
Refers to how language is presented on the device or software, and may include grids, visual scenes, keyboards, or a combination.

Output
The means by which the device or software produces a message that can be heard or read by the user and communication partners.

[Submit](#)

Select specific feature

Thinking about Thinking for AAC [Home](#) [Go to Library](#) [Learn More](#) [Log In](#)

[Expand All](#)

Access
The means by which the user makes selections on the device or software.

Direct Selection

- ☐ Body Part Making Direct Contact with Device
Any anatomical part used to make a selection on an AAC device by making direct contact with device (e.g. finger, fist, toes)
- ☐ Adaptive Tool Making Direct Contact with Device
A user makes a selection on the device by using an adaptive tool to make direct contact with the device (e.g. head stick, stylus, mouth stick)
- ☐ Adaptive Tool for Cursor Control
A user makes a selection on the device using an adaptive tool to control a cursor on the screen (e.g. eye tracking, mouse, joy stick, track ball, head tracking)

Indirect Selection

- ☐ Linear Scanning
A cursor light or arrow moves across each item in the first row, each item in the second row and each item in the subsequent row until an item is selected.
- ☐ Circular Scanning
The AAC device displays individual items in a circle and scans them electronically, one at a time, until the individual stops the scanner and selects an item.
- ☒ Row-Column Scanning
Rows when groups of items (a row of letters) are scanned and, once a group is selected, individual items (letters in the row) are individually scanned until a choice is indicated.
- ☐ Auditory scanning
Auditory activation feedback may be a label or message produced by an electronic communication device while scanning.



Cognitive demand literature provided

Thinking about Thinking for AAC Home Go to Library Learn More Log In

Access: Indirect Selection: Row-Column Scanning

Attention

Typically developing children responded with greater accuracy using direct selection as opposed to row-column scanning. Errors increased as a function of task complexity and decreased as a function of age. It was suggested that this is due to the attention demands of the task.

References:

- Miyake, M., Naito, L., Kurihara, A., & Imai, J. (1994). Effects of selection techniques and array size on short-term visual memory. *Augmentative and Alternative Communication*, 10(4), 237-244. <https://doi.org/10.1080/07434849412331276940>
- Ruffell, A. (1994). Comparison of relative demands implicated in direct selection and scanning: Considerations from normal children. *Augmentative and Alternative Communication*, 10(2), 67-74. <https://doi.org/10.1080/0743484941233127670>

• The slow rate of scanning places extra demands on the child's attention. It is more difficult to remember the intended message and to maintain attention to a task during scanning due to the time spent waiting.

References:

- Scanning requires the user to inhibit overt responses to each and every symbol that is highlighted prior to reaching the target; this clearly taxes attention.
- References:

• Scanning places a high requirement on attention skills than direct selection.

Memory

Scanning places demands on short-term memory because of the slow rate of output of communication with the row-column scanning process.

References:

- Normally developing children (grades 1-5) using row-column scanning made more errors on an auditory comprehension task and took longer to respond than when using direct selection. Scanning has greater memory demands.
- References:

• The slow rate of scanning places extra demands on the child's memory. It is more difficult to remember the intended message and to maintain attention to a task during scanning due to the time spent waiting.

Part Two: A downloadable PDF

Cognitive Demands Report

Cognitive Demands placed on the AAC Technology user.

Please note: The Cognitive Demands Report may be missing information about the cognitive demands of some of your selected features due to a lack of research literature about these features. If no information is available, the text "No research found" will appear in the report.

Created on Wed Jan 16 09:24:57 PST 2019

Selected Features

- Access: Indirect Selection: Row-Column Scanning

Cognitive Demands

Access: Indirect Selection: Row-Column Scanning

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Containing an annotated bibliography and a summary of literature findings.

Selected literature references and summaries were generated by multiple members of RERC on AAC team during consensus process.

OREGON HEALTH & SCIENCE UNIVERSITY

Method: Local beta testing

- Identify expert representatives of the following fields:
 - AAC experts (including clinicians, industry and designers)
 - Cognition experts
- Try *Thinking about Thinking for AAC* site with three different AAC technologies.
- Use "think out loud" procedure to gain qualitative information about their experience
- Provide questionnaires for quantitative feedback
 - Rate value as a clinical/design resource
 - Rate usability of website and overall design



Results from Beta n=10

Beta Participant Affiliation	Cognitive Expert	AAC Expert	Industry Rep	General Clinician
Faculty from SLP programs	1	1		
OT/ATP (child/adult provider)		1		
Home health SLP (adult provider)		1		
Outpatient SLP (child/adult provider)		1	2	3



Feature checklist: iPad with Go Talk Now

Access

- **Direct Selection:** With a body part

Language

- **Representation:** Photographs

Display

- Static Display
- Visual Scene Display
- Hot spot

Output

- **Speech Output:** Digitized (Recorded) Speech



Feature checklist: Tobii T-10

Access

- **Indirect Selection:** Row-Column Scanning

Language

- **Organization:** Categories/Group/Themes
- **Rate Enhancement:** Word/Message Prediction
- **Representation:** Text

Output

- **Speech Output:** Synthesized Speech

Display

- Dynamic display
- Keyboard
- Color
- Message Window
- Grid Display



Average Ratings by Local Beta Testers



Qualitative Feedback

"I would have found this helpful during my AAC class, to supplement other resources we learned about. Obviously it's not an assessment tool but at least it's a place to start."

"Glad for this resource because there are people who do not refer clients to me because they believe that the client cannot benefit from AAC/use of technology because of cognitive reasons"

"I wonder if this was study was on adults or peds? It would be interesting to find out if the cognitive demand is the same."

"This is hard information to take for someone who has not considered cognition before. It needs to be simpler. Maybe it's the examples; they are good but need to be simplified somehow."

"It stimulates a lot of clinical questions and gets people thinking about cognition, which is good. The cognitive demands of AAC are an afterthought; this emphasizes to learn & develop cognitive skills is important and can happen with consistent teaching and instruction"

Qualitative Feedback

"I could use citations in writing a funding report to support my recommendations."

"The summaries take a long time to get to the 'meat' or gist of the literature. (What does this say exactly?)"

"I could use when talking about parents or family members to justify a programming decision (e.g. photographs as a symbolic decision) for an individual's AAC device."

"Need to separate adult/child literature"

Lessons learned

- Additional research is needed for cognitive demands of AAC device features.
- Many studies that do exist are **NOT** representative of AAC users.
- Literature that does exist may discuss impact theoretically but does not empirically investigate the cognitive demand of feature.

Expected outcomes

- Web-based application
- Free of charge to AAC stakeholders
- Marketed through AAC stakeholder groups and industry conferences



This research is supported by the National Institute on Disability, Independent Living and Rehabilitation Research, grant #90RE5017. NIDILRR is a center within the Administration on Community Living, Department of Health & Human Services.

We thank members of the RERC on AAC, Invotek, and OHSU REKNEW team (Becky Pryor, Brandon Eddy, Deirdre McLaughlin, Betts Peters) for their contributions to this research.

