Augmentative and Alternative Communication: Cognitive Processes Involved in Progressing from an Initial Learner to an Experienced User of Icon-Sequencing Communication Devices

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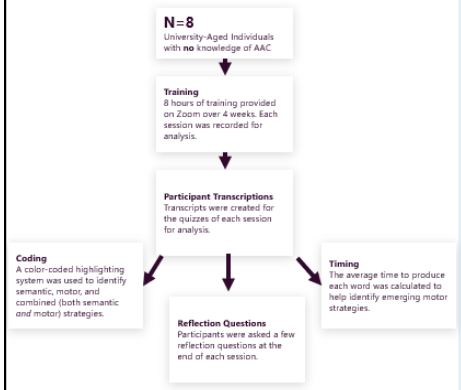
Background

Augmentative and Alternative Communication (AAC) refer to many different devices, no-tech to high-tech that help nonverbal people to communicate. Understanding the learning process could improve teaching strategies and utility of the device.

Methods

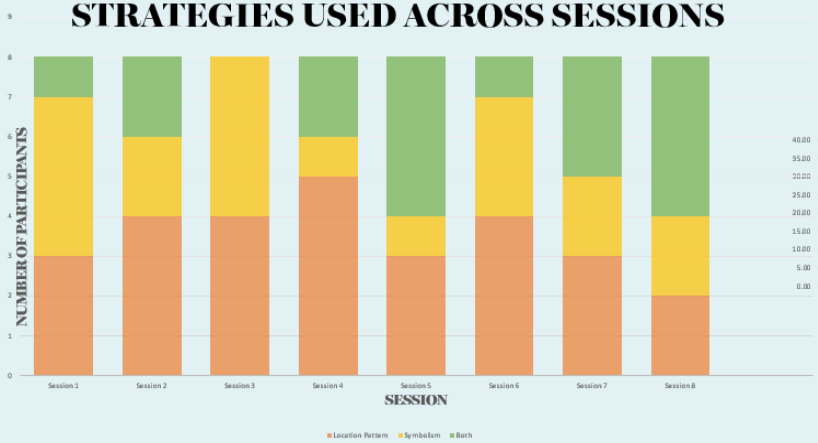


Discussion

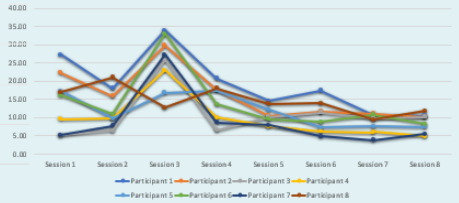
Results may indicate that instructional methods at later stages of learning should focus on semantic associations of icon symbols with less emphasis on location pattern. This approach may help AAC-learners with executive function deficits to easily find less frequently needed words with less tax on memory systems.

New learners rapidly learn to combine strategies to produce words as they gain mastery of high-tech AAC.

PARTICIPANT REPORT OF STRATEGIES USED ACROSS SESSIONS



Average Time to Produce Each Word/? in Seconds



Home Page of LAMP

Take a picture to download the poster, resources, and more!

Definitions

- Augmentative and alternative communication (AAC) is an area of clinical practice that addresses the needs of individuals with significant and complex communication disorders characterized by impairments in speech-language production and/or comprehension, including spoken and written forms. (ASHA, n.d.)
    - Augmentative refers to supplementing existing speech. Alternative means in place of speech that is either absent or nonfunctional.
- An AAC device typically refers to a speech-generating device, a high-tech piece of equipment that looks similar to tablets and iPads. It generates speech electronically. (ASHA, n.d.)
- LAMP-Words for Life (LAMP-WFL) is an AAC system created by PRC-Saltillo that utilizes icon sequencing. Icon sequencing means that the user must select a sequence of icons to produce their message.
- PASS-software is a computer program for computers with a Windows operating system to allow the computer to run LAMP-WFL.
    - https://www.prentrom.com/prc_advantage/free-software-download-pass
- Icon symbolism refers to the meaning of the image on each icon of an icon-based AAC system. These help to illustrate the meaning of the icon, and to indicate what words can be found on secondary and tertiary screens. These give the icons what is termed iconicity. (ASHA, n.d.)

Samples of Coded Transcripts

Red indicates use of a semantic strategy. Blue indicates use of a motor strategy. Yellow indicates use of both a semantic and motor strategy.

1. think, think, eh. Where is the brain? Eh. Thinking. Uh. Oh. Okay. I'm going to the fifth button of the sixth row, it's a woman pointing to her head with the lightbulb. Clicking it once. Brings up a secondary screen. To make the word "thinking" I'm going to the fifth button of the third row. Clicking on the "thinking' button with the "plus -ing" bucket. Then I'm clearing my screen.

2. Um. Going to the fourth button of the third row. It (unintelligible) "is". It has a bucket with water coming out "plus -s".

3. Okay, I'm going to the eight button of the third row. I'm clicking on the bucket that says "2+".

4. Okay I'm going to the seventh button of the third row. It is a upside down bucket with water coming out, says "+en". Light green button says "on".

5. Okay, I'm going to the seventh row and the fifth button in that row. It is the word "eat" with an "a" and an apple. Clicking on it to get a secondary screen. Going to the fifth word of the third row, it says "eating' with the "-ing" bucket with water coming out.

6. Okay. Going to the fifth word of the seventh; fifth word of the seventh row. Word eat with an "a" and an apple. Clicking it. Okay, going to the seventh word of the third row. It is "eaten" with the "+en" bucket that's upside down water.

1) He is happy
   a) Going to the left side of the screen, clicking on the yellow He icon twice.
   b) Going to the middle of the screen, clicking on the green icon that says is,
   c) going to the feel icon in the middle of the screen, going to the happy icon in the top left, clicking the bar at the top
2) I was scared
   a) Clicking on the I icon on the left side of the screen twice
   b) Clicking on the was icon in the middle of the screen
   c) Clicking on the feel icon in the middle of the screen …. Clicking on the scare icon on the left side of the screen, and clicking on scared in the middle of the screen, clicking the bar at the top
3) How many fish
   a) Going to the what icon in the top right of the screen, clicking on the hammer and question mark icon on the right side of the screen
   b) … clicking on the have icon in the middle of the screen… nope clicking out
   c) Clicking on the more icon on the right side of the screen….. Nope… Going to the word finder feature… oh that right, Going to the more icon on the right side of the screen, clicking on the many tile on the third row
   d) Going to the eat icon on the bottom of the screen, going up to meat/seafood at the top of the screen, then going to seafood or nope…. Going over to seafood… whoops sorry… Come icon on the middle of the screen, pet/farm on the top

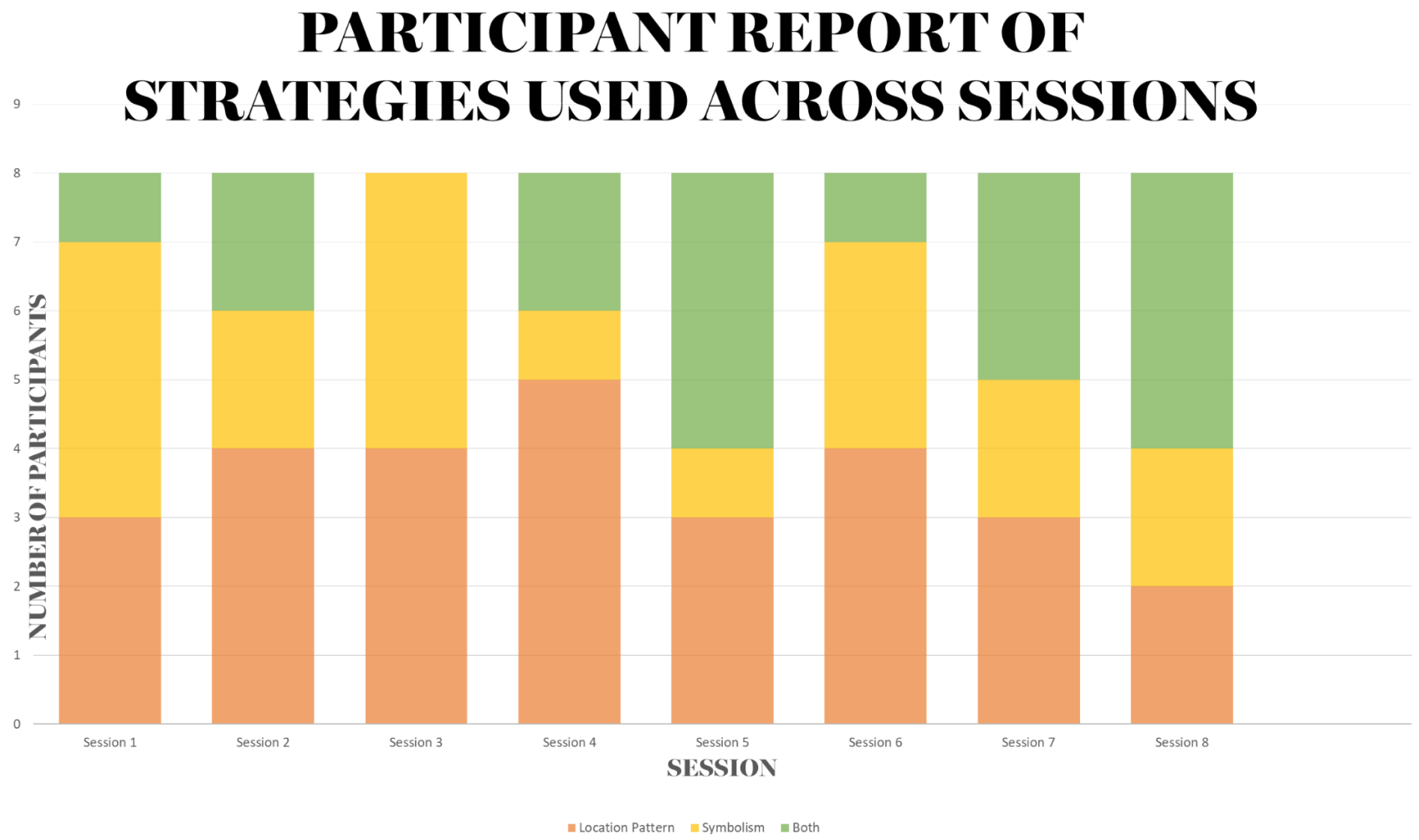
Left: Transcript from an early session (pre-session 5)
Right: Transcript from a later session (post-session 5)

Each transcript was coded and tallied to identify how much semantic, motor, and combined strategies were used, respectively. A ratio of strategies used each session was then calculated for each participant. (See below) Based on participant-reported strategy usage asked at the end of each session, strategies identified from verbalizations did not always match up to responses to reflection questions (e.g., "Did you rely more on the symbolism of the icons or the icon location pattern to find a word?). (See Figure 1)

Ratio of Strategies Used Across Sessions & Participants								
Session	**Participant 1**	**Participant 2**	**Participant 3**	**Participant 4**	**Participant 5**	**Participant 6**	**Participant 7**	**Participant 8**
1	6% Semantic	11% Semantic	0% Semantic	0% Semantic	22% Semantic	0% Semantic	0% Semantic	0% Semantic
	6% Motor	5% Motor	100% Motor	100% Motor	78% Motor	0% Motor	100% Motor	96% Motor
	88% Combined	84% Combined	0% Combined	0% Combined	0% Combined	100% Combined	0% Combined	4% Combined
2	0% Semantic	0% Semantic	0% Semantic	0% Semantic	0% Semantic	0% Semantic	0% Semantic	0% Semantic
	0% Motor	0% Motor	100% Motor	100% Motor	100% Motor	33% Motor	100% Motor	100% Motor
	100% Combined	100% Combined	0% Combined	0% Combined	0% Combined	67% Combined	0% Combined	0% Combined
3	0% Semantic	0% Semantic	0% Semantic	0% Semantic	0% Semantic	6% Semantic	0% Semantic	0% Semantic
	29% Motor	50% Motor	100% Motor	100% Motor	100% Motor	82% Motor	100% Motor	100% Motor
	71% Combined	50% Combined	0% Combined	0% Combined	0% Combined	12% Combined	0% Combined	0% Combined
4	9% Semantic	0% Semantic	0% Semantic	0% Semantic	2% Semantic	0% Semantic	0% Semantic	0% Semantic
	76% Motor	8% Motor	100% Motor	100% Motor	96% Motor	93% Motor	100% Motor	98% Motor
	15% Combined	92% Combined	0% Combined	0% Combined	2% Combined	7% Combined	0% Combined	2% Combined
5	4% Semantic	3% Semantic	0% Semantic	0% Semantic	5% Semantic	0% Semantic	0% Semantic	0% Semantic
	94% Motor	39% Motor	100% Motor	100% Motor	94% Motor	97% Motor	100% Motor	100% Motor
	2% Combined	58% Combined	0% Combined	0% Combined	1% Combined	3% Combined	0% Combined	0% Combined
6	0% Semantic	0% Semantic	4% Semantic	0% Semantic	0% Semantic	0% Semantic	0% Semantic	0% Semantic
	100% Motor	12% Motor	100% Motor	100% Motor	98% Motor	98% Motor	100% Motor	100% Motor

	0% Combined	88% Combined	0% Combined	0% Combined	2% Combined	2% Combined	0% Combined	0% Combined
7	0% Semantic	2% Semantic	0% Semantic	0% Semantic	4% Semantic	0% Semantic	0% Semantic	0% Semantic
	99% Motor	34% Motor	99% Motor	100% Motor	95% Motor	97% Motor	100% Motor	99% Motor
	1% Combined	64% Combined	1% Combined	0% Combined	1% Combined	3% Combined	0% Combined	1% Combined
8	0% Semantic	1% Semantic	0% Semantic	1% Semantic	12% Semantic	0% Semantic	0% Semantic	0.2% Semantic
	99% Motor	43% Motor	99% Motor	99%% Motor	84% Motor	98% Motor	100% Motor	95% Motor
	1% Combined	56% Combined	1% Combined	0% Combined	4% Combined	2% Combined	0% Combined	4.8% Combined

Figure 1


PARTICIPANT REPORT OF STRATEGIES USED ACROSS SESSIONS
NUMBER OF PARTICIPANTS
0
1
2
3
4
5
6
7
8
9
Session 1
Session 2
Session 3
Session 4
Session 5
Session 6
Session 7
Session 8
SESSION
Location Pattern
Symbolism
Both

*Location Pattern = Motor, Symbolism = Semantic, Both = Combined

Time Per Word Analysis

The average time taken to produce each word and "?" was calculated for each participant during each session's knowledge check and final quiz. For sessions 1-4, times were not controlled for unfamiliar vocabulary since the participants needed to first gain familiarity with the device. In the beginning, all of the word locations were unfamiliar to the participants. Familiarity was established in sessions 1-4. Sessions 5-8 thus had times controlled for unfamiliar vocabulary.

Unfamiliar vocabulary was determined by inputting all words participants were asked to produce at any point during the 8 sessions into Excel. Unfamiliar vocabulary was then defined as any word participants were asked to produce 3 or fewer times.

Assessment of Unfamiliar Vocabulary Parameters and Familiarity Establishment

Outliers Captured by Unfamiliar Vocabulary Parameters								
Session	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**
4	1/14 7%	1/14 7%	0/1 0%	0/4 0%	1/6 17%	0/6 0%	0/2 0%	0/5 0%
5	5/14 (36%)	6/9 67%	3/6 50%	5/7 71%	5/8 63%	6/10 60%	2/4 50%	7/11 64%
6	3/10 30%	2/4 50%	3/5 60%	2/4 50%	1/4 25%	2/3 67%	1/1 100%	2/4 50%
7	12/15 80%	13/16 81%	10/16 63%	12/14 86%	8/9 89%	7/9 78%	7/8 88%	9/14 64%
8	31/44 70%	41/46 89%	34/44 77%	21/25 84%	28/32 88%	38/47 81%	21/23 91%	30/39 77%

The high number of uncaptured outliers in session 4 indicates lack of familiarity.

Makeup of Uncaptured Outliers								
Session	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**
4	**13/13 CNR** (100%)	**10/14 LV** (71%) **3/14 CNR** (21%) **1/14 E** (7%)	**1/1 CNR** (100%)	**2/4 E** (50%) **1/4 CNR** (25%) **1/4 LV** (25%)	**5/5 CNR** (100%)	**2/6 CNR** (33%) **4/6 LV** (67%)	**2/2 CNR** (100%)	**5/5 CNR** (100%)
5	**2/9 CNR** (22%) **7/9 LV** (78%)	**3/3 CNR** (100%)	**2/3 CNR** (67%) **1/3 LFE** (33%)	**2/2 CNR** (100%)	**2/3 CNR** (67%) **1/3 E** (33%)	**2/4 CNR** (50%) **2/4 LV** (50%)	**2/2 CNR** (100%)	**1/4 E** (25%) **3/4 CNR** (75%)
6	**5/7 CNR** (71%) **2/7 E** (29%)	**1/2 CNR** (50%) **1/2 LV** (50%)	**1/2 E** (50%) **1/2 LV** (50%)	**1/2 CNR** (50%) **1/2 E** (50%)	**3/3 CNR** (100%)	**1/1 CNR** (100%)	N/A	**2/2 CNR** (100%)
7	**3/3 CNR** (100%)	**2/3 LV** (67%) **1/3 CNR** (33%)	**4/6 LV** (67%) **2/6 LFE** (33%)	**1/2 CNR** (50%) **1/2 E** (50%)	**1/1 CNR** (100%)	**2/2 CNR** (100%)	**1/1 E** (100%)	**3/5 E** (60%) **2/5 CNR** (40%)
8	**3/13 E** (23%) **7/13 LV** (54%) **2/13 LFE** (15%) **1/13 CNR** (8%)	**3/5 CNR** (60%) **2/5 LV** (40%)	**3/10 CNR** (30%) **3/10 LV** (30%) **2/10 LFE** (20%) **2/10 E** (20%)	**3/4 CNR** (75%) **1/4 E** (25%)	**4/4 CNR** (100%)	**7/9 CNR** (78%) **1/9 E** (11%) **1/9 T** (11%)	**1/2 CNR** (50%) **1/2 E** (50%)	**8/9 CNR** (89%) **1/9 LFE** (11%)

*CNR = Could not remember location

*E = Error

*LFE = Looking for efficiency (e.g., 2 words with one icon hit)

*LV = Long verbalization

*T = Typed on QWERTY keyboard of device instead of sequencing icons

10-Point Likert Scale

After completing the final session, participants were asked to rate how easily they were able to learn to use the device using a 10-point Likert scale. One is defined as being the easiest and ten is defined as most difficult. (Likert, R., 1932)

Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6	Participant 7	Participant 8
5	3	1 to 2	4	5	5	4	3 to 4

References

American Speech-Language-Hearing Association (n.d.). *Augmentative and Alternative Communication* (Practice Portal). Retrieved from www.asha.org/Practice-Portal/Professional-Issues/Augmentative-and-Alternative-Communication/.

Garrett, D., Willis, E., Loncke, F. (2021, November). Identifying Cognitive Processes Utilized in Generating Messages through Icon Sequencing. [Virtual Library Presentation]. ASHA National Convention 2021. Washington, D.C.

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Likert, R. (1932). A Technique for the Measurement of Attitudes. *Archives of Psychology*, 140, 1–55.