Optimizing Language Outcomes for Young Adults with Intellectual and Developmental Disabilities: A Written Language Intervention Using Functional Texts – Study Protocol and Statistical Analysis Plan

BACKGROUND

Purpose
This study is designed to to examine the feasibility, acceptability, and initial effectiveness of a Written Language Intervention Using Functional Texts (WLIFT) for young adults with intellectual and developmental disabilities (IDD).

Research Questions/Specific Aims
AIM 1: To examine the effects of WLIFT intervention on use of reading comprehension strategies in functional texts by young adults with IDD.
AIM 2: To examine the effects of the intervention on distal written language outcomes.
AIM 3: To examine the effects of the intervention on distal spoken language outcomes.

Dependent Variables (DV)
Primary Outcome: Participant Use of Comprehension Strategies
The primary DV for this study will be the total number of different reading comprehension strategies used during each probe. In the primary DV probe, the participant is prompted to read a functional text stimuli using a think-aloud to implement the reading comprehension strategies. Participants' use of the reading comprehension with a graphic organizer will be measured across the various functional literacy stimuli.

Step	Operational definition	No credit
1. Review strategy	Naming the "reading strategies"; mention completing tasks before, during, and after reading; name each step or at least 4/10 steps, ten steps	No review of strategy, reading strategy
2. Identify type of text	Identifying whether the text is text message, GroupMe message, email, assignment, etc.	Vague description
3. Identify context of text	Name person(s) or role (e.g., boss, friend) or identify context (e.g., bank, transportation)	No response
4. Read text **(NOT SCORED)**	Read text aloud or to themselves (e.g., looking at screen, eyes scanning text, silent pause, "I'm done")	If don't finish text in its entirety, no reading
5. Look for words I need help with	Identify a word they don't know, acknowledge (verbally or nonverbally) that they know all the words or that they looked at back at the text	Very quick scan of text, don't look at text
6. Re-read	Repeat any part of the text	Summarize and not read directly
7. Ask "Do I understand what I just read?"	Verbalize the question, acknowledge that they understand everything (e.g., "I've got it!")	No self-monitoring, obvious lack of comprehension
8. Summarize what I read	Verbal (mostly correct and complete) summary of text, list notes	Vague or incomplete summary

9. Ask "Do I need more information?"	Verbalize the question and acknowledge that they don't need more information (e.g., "I'm good")	No check for missing information
10. Decide what to do next	State what to do next	No verbal comment or unrelated comment

Secondary Outcomes: Reading Comprehension (Written Language) and Spoken Language

- *Reading Comprehension of Functional Texts:* After reading a functional text, across multiple domains (e.g., social, vocational), the participant (a) answers multiple choice comprehension questions which are scored based on the percent answered correctly and (b) provides a written response to the functional text (e.g., text message or email reply) that is scored using a rubric rating.
- *Spoken Language:* After reading a functional text, across multiple domains (e.g., social, vocational), the participant provides a spoken response to the functional text (e.g., phone call reply to text message) that is scored using a rubric rating.

Intervention Development

The Written Language Intervention for Functional Texts (WLIFT): (a) utilizes functional texts—activities of daily living that involve written language (e.g., text messages), (b) is specifically designed based on the phenotype of commonly occurring IDDs and is delivered at a critical time as young adults transition to independence, (c) involves teaching and assessing comprehension strategies implemented before, during, and after reading that have been previously shown to be associated with stronger written and spoken language skills in struggling readers, and (d) is implemented via telepractice to promote service delivery in meaningful contexts for the individual with IDD.

The WLIFT components are summarized in Table 1. WLIFT includes reading comprehension strategies which are known to be effective for struggling readers that are explicitly taught to be implemented before, during, and after reading. WLIFT was developed using a novel approach in which empirical evidence on the behavioral phenotype of commonly occurring IDDs informed reading comprehension strategy selection.[30,31] Given deficits in working memory and executive functioning among individuals with IDD, reading comprehension strategies that directly and explicitly address these areas of need (graphic organizer and comprehension monitoring, respectively) are taught. To increase the likelihood for generalization and enhance participants' motivation, reading comprehension strategies are taught and practiced using researcher-developed functional literacy stimuli (e.g., text messages, emails) which closely reflect participants' daily written communications.

Table 1. WLIFT Components for Young Adults with IDD

When Implemented	Strategy	Description
Before, during, after	Graphic organizer	Visual display of reading comprehension strategies. Provides visual and working memory support.
Before	Activate prior knowledge	Brainstorm what is already known about the literacy context (e.g., review strategies, identify context, identify person corresponding with). Makes explicit connection between old and new knowledge.
During	Word-solving (decoding)	Identify unknown words, read again, sound out, and/or parse into smaller parts. Facilitates accurate decoding.

	Comprehension monitoring	Detect breakdowns in comprehension by drawing on literacy and language knowledge to evaluate whether one understands what is read and if not, react effectively by problem solving. Provides executive functioning support.
	Repeated reading	Re-read text. Facilitates reading accuracy and speed which enables comprehension.
	Visualization & summarization	Differentiate important from unimportant ideas and then synthesize and create a mental image of important details. Facilitates efficient use of meta-cognitive skills using multimodal sensory support to visualize important details so cognitive resources are not expended on irrelevant details.
After	Planning	Clarify ambiguous ideas by asking self if more information is needed which informs deciding what to do next in the functional literacy context (e.g., respond to message, complete assignment, add work shift to calendar). Provides executive functioning support.

Note. This table is informed by the work of the National Reading Panel (2000) and Shanahan et al. (2010).

From the outset of the intervention, the young adults with IDD are individually taught all of the strategies using a graphic organizer as visual support. The interventionist: (a) defines the reading comprehension strategies, (b) describes and models how to use the strategies before, during, and after reading, and (c) and answers any questions about the strategies. The participant practices all the strategies during the twice weekly sessions. Each session follows the components of the teach-model-coach-review format as described below. During the think-alouds, the participant is encouraged to tell the interventionist everything that they are doing as they implement the comprehension strategies. In addition to working directly with each participant with IDD to schedule all study sessions, we will also include parents/caregivers in all written communications or as needed to assist with scheduling logistics. Parents/caregivers are not required to be present during the intervention sessions.

Intervention Lesson Structure
1. Teach (introduction/review; 5 min)
    a. The interventionist reviews the intervention strategies previously taught.
2. Model (10 min)
    a. The interventionist models the intervention strategies using a think-aloud. The interventionist demonstrates the strategy via explicit modeling. The student is observing but not implementing in this step. This step is faded as the student requires reduced support to use the strategy and eliminated when the student can practice the strategy proficiently. The interventionist judges when explicit modeling is no longer needed.
3. Coach (15 min + 10 min)
    a. The young adult with IDD practices the strategies with support from the interventionist across multiple functional literacy stimuli. The interventionist guides the student to use the strategy when reading aloud. The interventionist and the student work together to implement the strategy. The interventionist models and prompts the student to use the strategy with multiple opportunities for practice. This step is faded (i.e., decreased time allotted and then eliminated) as the student demonstrates independence.
    b. The young adult with IDD uses a think-aloud to practice the strategies independently using one functional literacy text.

4. Review (5 min)
   a. The interventionist reviews the strategies, summarizes the session, and answers any questions. The participant practices the strategy and the interventionist provides positive reinforcement and feedback to encourage the student and to acknowledge accurate implementation of the strategy. The interventionist provides scaffolds only as needed, for example, when the student is not accurate in employing the strategy. It is anticipated that this step will be deployed with increasing independence over the course of the intervention phase.

Functional Literacy Text Development

- The following text parameters are analyzed using the Readability Test Tool for each functional literacy text used in the study (https://www.webfx.com/tools/read-able/):
  - Total number of sentences
  - Total number of words
  - Number of complex words
  - % Complex words
  - Average number of words per sentence
  - Average number of syllables per word
  - Flesch reading ease
  - Flesch-kincaid grade level
- Three text samples across the following domains were gathered to develop text readability guidelines: Social-GroupMe, Academic-Email (program and instructor), Academic-assignments, Academic-Syllabus (only 2 samples).
- The following parameters are used to develop additional functional literacy texts:

Text	TNS	TNW	# Complex words	% Complex words	Avg # Words/Sent	Avg # Syll/Word	Flesch Rdg Ease	Flesch-Kincaid Gr	Notes
All texts	**4-12**	**25-120**	**2-12**	**4-15**	**5-15**	**1-2**	**60-100**	**1.7-5.0**	Include 2-10 exchanges in social texts (text msgs, GroupMe)
Note. TNS = total number of sentences, TNW = total number of words									

STATISTICAL ANALYSIS PLAN

Primary research aim:
1. To examine the effects of the WLIFT intervention on use of reading comprehension strategies in functional texts by young adults with IDD.

Secondary research aims:

1. To examine the effects of the intervention on distal written language outcomes.
2. To examine the effects of the intervention on distal spoken language outcomes.

Data in both experimental conditions will be analyzed using *t* tests to compare average gain scores between treatment and control groups for each of the primary and secondary outcomes. Covariates (e.g., nonverbal cognition, socioeconomic status) will be included in ANCOVA analyses as necessary to correct for average group differences at pretest on key variables. Appropriate non-parametric methods (Wilcoxon rank sum tests) will be used if there are issues with model assumptions due to the nature of the data.