What is the Effect of Personalized Cognitive Strategy Instruction on Facilitating Return-to-Learn for Individuals Experiencing Prolonged Concussion Symptoms?

Dissertation Defense

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Overview

1. Study rationale
2. Research questions
3. Methods
4. Results
5. Discussion and interpretation

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1. Study Rationale

A. Define concussion
B. Define prolonged concussion symptoms (PCS)
C. Summary of current treatment recommendations
D. Knowledge gap

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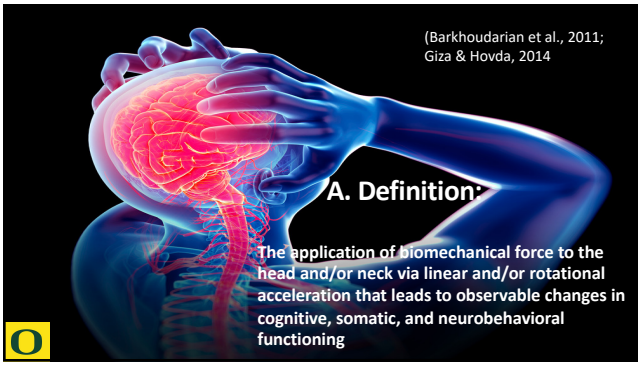

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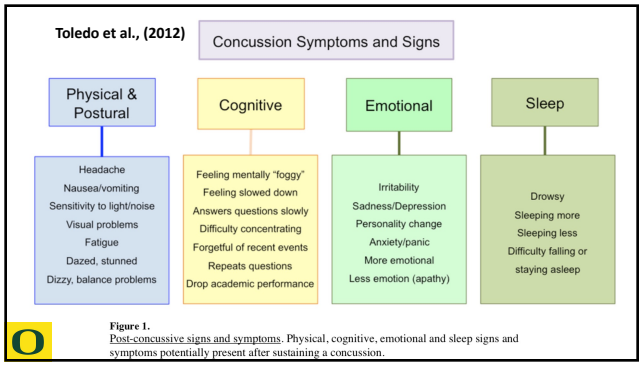

Figure 1.
Post-concussive signs and symptoms. Physical, cognitive, emotional and sleep signs and symptoms potentially present after sustaining a concussion.

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Symptom Clusters

More recent research suggests there are 6 symptom clusters (Lumba-Brown, 2019, Harmon, 2019)

1. Headache-Migraine Symptom Cluster
2. Cognitive Symptom Cluster
3. Anxiety-Mood Symptom Cluster
4. Ocular-Motor Symptom Cluster
5. Vestibular Symptom Cluster
6. Sleep Symptom Cluster

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B. PCS Defined

- Occurs in 10-15% of the 1.6-3.8 million annual concussion cases
- General consensus between DSM-IV and ICD-10 in diagnostic criteria of PCS
- Defined as the presence of three or more symptoms for at least three months following the injury
- Contributing factors to PCS development:
  - Pre-injury risk factors
  - Injury-related risk factors
  - Post-injury risk factors

(Babcock et al., 2013; Zemek et al., 2013)

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C. Summary of Current Treatment Recommendations

- Variety of approaches to managing PCS with limited research
- Historically evaluated in manualized programs
- Support for multidisciplinary treatment
- Interventions must account for interaction of symptom clusters
- Improvements with psychoeducation and cognitive strategy instruction have been noted

(Cooper et al., 2016; Huckans et al., 2010; Sohlberg & Ledbetter, 2016; Storzbach et al., 2017; Twamley et al., 2014)

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C. Summary of Current Treatment Recommendations

- Retrospective research has influenced my approach to a personalized and dynamic treatment
  - Identify client needs
  - Match treatment components to client's needs
  - Implement dynamic intervention dependent upon client progress

(Wright et al., 2020)

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D. Knowledge Gap

1. Understanding of which treatment components are most faciliatory in returning students experiencing PCS to pre-injury level
2. Understanding of the benefit of personalizing selection of cognitive strategies to meet individual needs
3. The need for a protocol that can feasibly be implemented in school or clinic settings

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2. Research Questions

1. Is there a functional relation between the addition of personalized cognitive strategy instruction to psychoeducation and the achievement of student RTL targets?
2. Do selected scores on the pre/post outcome measures that aid in the treatment selection process yield positive change following the delivery of personalized cognitive strategy instruction?

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3. Methods

A. Setting and participant characteristics
B. Experimental design
C. Procedures
D. Measurements
E. Analyses

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A. Setting and Participant Characteristics

- Brain Injury and Concussion Clinic (BrICC) outpatient services
- All sessions conducted via telehealth over zoom
- All sessions facilitated by two graduate student clinicians

Eligibility Requirements:

- Ages 13-17
- Experiencing PCS
- Referred to BrICC to treating ongoing cognitive challenges

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A. Setting and Participant Characteristics

Participant	Sex	Age	Etiology	Number of Previous Concussions	History of Depression or Anxiety	Time Post Onset (months)
Participant 1	Female	16	Motor vehicle accident	0	No	3.5
Participant 2	Female	15	Sport-related concussion	1	Yes	7.5
Participant 3	Female	13	Fall	3	Yes	9

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B. Experimental Design

- Single case experimental design
  - Non-concurrent multiple-baseline design
- Steps to strengthen internal validity
  1. IV implementation staggered across participants
  2. Randomized order of staggered IV implementation

(Byiers et al., 2012; Harvey et al., 2004; Horner et al., 2005; Kratochwill & Levin, 2010; Watson & Workman, 1981)

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C. Procedures

- Two phases
  1. Baseline (delivery of psychoeducation)
  2. Experimental (implementation and delivery of the IV, personalized cognitive strategy instruction)
- 13 total sessions per participant

Table 3

Implementation Order of Personalized Cognitive Strategy Instruction

Participant	Implementation session
Participant 1	7
Participant 2	4
Participant 3	9

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C. Procedures – Baseline Phase

Clinical Interview

- Session 1
- Identify participant concerns and develop goals

Goal Formation

- Session 1
- Influenced by participant responses in clinical interview and BRIEF-2/CLASS
- Reflect cognitive domain and academic behavior targeted

Psychoeducation

- Implemented during clinical interview and every baseline session
- Uniform across all participants

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C. Procedures – Baseline Phase (Clinical Interview)

- Open-ended questions
  - What are you concerns since the concussion?
  - If you could make progress in one area, what would it be?
  - What has changed since your concussion?
  - What have you tried?
- Validation and self-reflection of participant statements
- Facilitates the identification of priorities and goal development

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C. Procedures – Baseline Phase (Psychoeducation)

- Uniform delivery across participants
- Three specific topics
  1. Symptom expectations
  2. Symptom duration
  3. Symptom management
- Delivered via didactic instruction with teach-back

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C. Procedures – Experimental Phase

Personalized Cognitive Strategy Instruction

- Implemented during final baseline session to begin measuring impact the following session
- Purpose is to identify strategy for participant that addresses their concerns and can compensate for cognitive challenges

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D. Measurements

Repeated Measures	Pre/Post Outcome Measures	Treatment Implementation and Outcome
1. Baseline and Intervention Phase 1. Status tracking 2. Baseline Phase 3. Experimental Phase 1. Frequency of strategy use 2. Perceived strategy helpfulness	1. Goal Attainment Scale (GAS) 2. Behavior Rating Index of Executive Function (BRIEF) 3. Concussion Learning Assessment and School Survey (CLASS) 4. Post-Concussion Symptom Scale (PCSS)	1. Treatment fidelity 2. Social validity and treatment appropriateness 3. Treatment attendance

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D. Measurements - Repeated Measurements (Status Tracking)

- Collected every session during both phases
- Directly corresponded to participant GAS
- Aligned with participant functional goal
- Primary indicator of responsivity to treatment
- Primary measurement analyzed to determine existence of functional relation
- Hypothesized to increase with the introduction of personalized cognitive strategy instruction

(Ownsworth et al., 2000; Toglia & Kirk, 2000)

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D. Measurements - Repeated Measurements (Frequency of Strategy Use)

- Rationale:
  - has been measured in previous mTBI literature
  - Frequency identified to increase post-intervention
- Present study:
  - Hypothesized that elevated and sustained frequency of strategy use would occur parallel to increased and sustained progress on status tracking measurement

(Huckans et al., 2010; Storzbach et al., 2017)

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D. Measurements - Repeated Measurements (Perceived Strategy Helpfulness)

- Rationale:
  - has been measured in previous mTBI literature
  - Strategies found to be more helpful in individuals with high frequency of use
- Present Study:
  - Hypothesized that elevated and sustained strategy helpfulness would correspond with sustained improvements on status tracking measurement
- Measured on a 1-5 scale:
  - 1 = not helpful at all
  - 2 = not helpful
  - 3 = somewhat helpful
  - 4 = helpful
  - 5 = very helpful

(Huckans et al., 2010; Storzbach et al., 2017)

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D. Measurements – Pre/Post Outcome Measurements

1. Goal Attainment Scale (GAS)
2. Behavior Rating Index of Executive Functioning* (BRIEF)
3. Concussion Learning Assessment and School Survey* (CLASS)
4. Post-Concussion Symptom Scale (PCSS)

- *Administered to both participant and their parent
- BRIEF, CLASS, and PCSS administered three times
  1. Session 1 (clinical interview)
  2. Transition from baseline phase to experimental phase
  3. Completion of study

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D. Measurements - Pre/Post Outcome Measurements (GAS)

- Hierarchy of potential outcome with 5 discrete, equidistant levels
  - Best possible improvement
  - Better than expected improvement
  - Expected improvement
  - Baseline performance
  - Much less than expected performance
- Aligned with participant treatment goals
- Directly corresponded to status tracking measurement
- Participants hypothesized to obtain and sustain expected levels of performance or greater with introduction of personalized cognitive strategy instruction

(Grant & Ponsford, 2014; Krasny-Pacini et al., 2013; Malec, 2001)

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D. Measurements - Pre/Post Outcome Measurements (BRIEF)

- Questionnaire to measure executive functioning and behavioral regulation skills
- Parent and participant report
- BRIEF-2: participants ages 13-17

- Rationale for present study:
  - Identify clinically elevated scores at first administration to assist in goal formation and eventual treatment selection
  - Hypothesized index/scale scores that influenced treatment at first administration would obtain most positive change following delivery of personalized cognitive strategy instruction

(Gioia et al., 2000)

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D. Measurements - Pre/Post Outcome Measurements (CLASS)

- 20-item questionnaire assessing:
  - Concern for injury's effect on school learning and performance
  - New or exacerbated post-concussion academic problems
  - Perceived impact on academic performance
- Parent and participant report

- Rationale for present study:
  - First administration – identify academic behaviors perceived to be challenging or stressful and influence treatment goal
  - Hypothesized that responses that influenced treatment selection at first administration would yield most positive change after delivery of personalized cognitive strategy instruction

(Ransom et al., 2015; Ransom et al., 2016)

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D. Measurements - Pre/Post Outcome Measurements (PCSS)

- 22-item symptom questionnaire
- Rated 0 (no symptoms) to 6 (severe symptoms)
- Symptoms 18-21 represent *cognitive symptom cluster*

- Rationale for present study:
  - Observe change in *cognitive symptom cluster* severity rating
  - Hypothesized *cognitive symptom cluster* severity ratings would decrease following the delivery of personalized cognitive strategy instruction

(Harmon et al., 2019; Kontos et al., 2012)

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D. Measurements – Measurements of Treatment Implementation and Outcome

1. Treatment fidelity
2. Social validity and treatment appropriateness
3. Treatment attendance

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D. Measurements – Measurements of Treatment Implementation and Outcome (Treatment Fidelity)

- Two observers
- Five fidelity checklists across both phases
- Session objectives rated on ordinal 0-2 scale
  - 0 = objective was not introduced or covered by clinicians
  - 1 = objective was partially achieved
  - 2 = objective was fully achieved
- Acceptable treatment fidelity = rating of 75% or greater
- Calculated inter-rater reliability of fidelity measurement with Cohen's *Kappa*
  - Acceptable agreement considered if there was weighted Cohen's *Kappa* of .60 or greater across sessions rated by both observers

(Cohen, 1968; Fleiss, 1973; Toglia et al., 2020)

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D. Measurements – Measurements of Treatment Implementation and Outcome (Social Validity and Treatment Appropriateness)

- Modified version of Treatment Acceptability Rating Form-Revised (TARF-R) (Reimers et al., 1992)
- Seven items
- Rated on 5-point Likert scale
  - 1 = Strongly disagree
  - 2 = Disagree
  - 3 = Neutral
  - 4 = Agree
  - 5 = Strongly agree

(Reimers et al., 1992; Schwartz & Baer, 1991)

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D. Measurements – Measurements of Treatment Implementation and Outcome (Treatment Attendance)

- Measured as number of sessions per participant that required rescheduling
- Participant 1 rescheduled two sessions
- Participants 2 and 3 rescheduled zero sessions

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E. Analyses

RESEARCH QUESTION 1

- Visual analysis
  - Level
  - Trend
  - Immediacy of effect
  - Consistency across phases
- Statistical analysis
  - *Tau-U*
  - Multilevel Modeling (MLM)

RESEARCH QUESTION 2

- Descriptive analysis
- Reliable Change Index (RCI)
  - analyze change in BRIEF-2 responses

(Hawley, 1995; Horner et al., 2005; Jacobson et al., 1999; Jacobson & Truax, 1991; Moeyaert et al., 2014; Parker et al., 2011; Shadish et al., 2008)

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4. Results

A. Treatment goals
B. Cognitive strategies
C. RQ 1 results
- Visual analysis
- *Tau-U*
- MLM
- GAS outcome
- Frequency of strategy use and perceived strategy helpfulness

D. RQ 2 Results
E. Treatment fidelity
F. Social validity and treatment appropriateness

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A. Treatment Goals

Table 5

Participant Treatment Goals

Participant	Goal
Participant 1	Increase the number of minutes per class engaged in online Literature class
Participant 2	Increase the number of minutes per week spent studying for Spanish class
Participant 3	Increase weekly assignment completion

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A. Treatment Goals

Table 6

Participant GAS Hierarchies

Level	Participant		
	Participant 1	Participant 2	Participant 3
Much more than expected	36 to 45 minutes engaged in online lecture	36 to 45 minutes per week studying Spanish	Complete 80 to 100% of weekly assignments
More than expected	26 to 45 minutes engaged in online lecture	26 to 45 minutes per week studying Spanish	Complete 60 to 79% of weekly assignments
Expected	16 to 25 minutes engaged in online lecture	16 to 25 minutes per week studying Spanish	Complete 40 to 59% of weekly assignments
Baseline	6 to 15 minutes engaged in online lecture	6 to 15 minutes per week studying Spanish	Complete 20 to 39% of weekly assignments
Decline	0 to 5 minutes engaged in online lecture	0 to 5 minutes per week studying Spanish	Complete 0 to 19% of weekly assignments

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B. Cognitive Strategies

Table 7

Participant Cognitive Strategies

Participant	Cognitive strategies implemented
Participant 1	Take a 5-minute break after listening to 15 minutes of online lecture
	Set reminders in phone to remember to take a break during lecture
Participant 2	Set two reminders to specific times per week to dedicate studying for Spanish class
	Use a "study buddy" for Spanish class to study with at least once per week
Participant 3	Use academic planner to track weekly assignments

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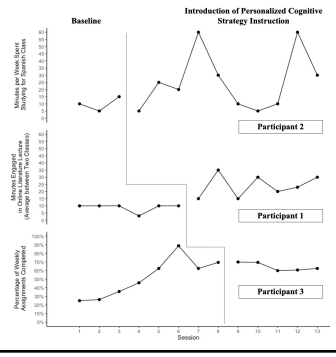
C. RQ 1 Results – Visual Analysis



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C. RQ 1 Results – *Tau-U*

Table 8

Tau-U Results

Value	Score
Tau-U	.605
z-Score	2.93
p-value	.0034

Note. The Single Case Research free calculator (http://www.singlecaseresearch.org/) was utilized to calculate the Tau-U effect size value. Participants 1 and 2 required a baseline trend correction.

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C. RQ 1 Results – MLM

Table 9

Multilevel Model Results

Value	Score	*p*-value
Autocorrelation	.494	
Effect size of change between phases	10.17	.177
Slope	1.84	.337

Note. MLM results were calculated using Rstudio version 1.4.

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C. RQ 1 Results – GAS Outcome

- All participants achieved expected level of performance
- Participants 1 and 2: following IV implementation
- Participant 3: preceding IV implementation

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C. RQ 1 Results – Frequency of Strategy Use and Perceived Strategy Helpfulness

PARTICIPANTS 1 AND 2

- Inconsistent strategy use and perceived helpfulness of first strategy
- Facilitated discussion on identification of second strategy
- Second strategy boosted use and perceived helpfulness of first strategy
- Results aligned with strategy use and helpfulness hypothesis

PARTICIPANT 3

- Stability of strategy use mirrored stability in status tracking measure across both phases
- Strategy use appeared to not influence status tracking measurement
- Sustained high helpfulness ratings

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D. RQ 2 Results – Observed Trends to BRIEF-2, CLASS, and PCSS Responses

Participant 1	Participant 2	Participant 3
• Elevated and sustained PCSS severity ratings • BRIEF-2/CLASS responses worsened • No significant RCI values comparing BRIEF-2 responses on self-report • Self/parent disparity on BRIEF-2/CLASS initial responses	• Responses improved on all measures • Significant RCI values obtained comparing BRIEF-2 responses on self/parent-report • Self/parent disparity on BRIEF-2/CLASS initial responses	• Responses improved on all measures • Significant RCI values obtained comparing BRIEF-2 responses on self/parent-report • Self/parent-report similarities on BRIEF-2/CLASS initial responses

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E. Treatment Fidelity

Observer	Fidelity Rating
1	95.99%
2	80.56%

Table 22

Weighted Cohen's Kappa Results

	K	*p*	95% CI	
			LL	*UL*
Value	.608	< .001	.437	.778

Note. Weighed Cohen's *Kappa* calculated with quadratic weights.

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F. Social Validity and Treatment Appropriateness

Table 23

Participant Responses to the Modified TARF-R

Item	Participant		
	Participant 1	Participant 2	Participant 3
The clinician's teaching of the cognitive strategy was effective	Agree	Agree	Agree
I was motivated to use my cognitive strategy outside of therapy sessions	Agree	Agree	Agree
The duration of time to learn my cognitive strategy was longer than anticipated	Agree	Neutral	Neutral
I am confident I learned my cognitive strategy	Agree	Strongly agree	Agree
Learning a cognitive strategy helped me reach my school and other goals	Strongly agree	Agree	Agree
I liked attending therapy sessions	Strongly agree	Agree	Neutral
I experienced discomfort learning and implementing a cognitive strategy to address my school and other goals	Disagree	Neutral	Disagree

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5. Discussion and Interpretation

A. Profiles of clinical response
B. Measurements
C. Study limitations
D. Summary and clinical implications

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A. Profiles of Clinical Response

- Two of three participants responded to intervention
- All participants achieved and maintained expected performance on GAS hierarchy
- Responses to TARF-R suggest all participants endorsed treatment
- Profiles emerged for each participant

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A. Profiles of Clinical Response

Participant 1	Participant 2	Participant 3
• Outcome aligned with RQ 1 only • Responded to collaborative goal development and status tracking measurement • Trajectory of BRIEF-2/CLASS/PCSS responses suggest complex recovery	• Outcome aligned with RQ 1 and 2 • Responsive to all components of intervention • Demonstrated ability to generalize strategy use to other courses	• Outcome aligned with RQ 2 only • Implementation of personalized strategy did not facilitate functional change • Apparent accountability of status tracking measurement • Influence of her age

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B. Measurements

- Facilitated dynamic intervention
- Baseline measurements dictated treatment development
- Ongoing measurement of participant performance dictated service delivery in the experimental phase
- Development of GAS hierarchy paired with ongoing status tracking most important

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B. Measurements

Repeated Measurements	Pre/Post Outcome Measurements
• Facilitated client-participant discussion and reflection on participant performance • Most useful for Participants 1 and 2 • Support the use of dynamic approach to treat PCS	• First administrations of BRIEF-2/CLASS critical to identifying need and establishing goals • Response pattens to BRIEF-2/CLASS/PCSS moved in tandem • Three administrations was tedious for participants • Participant 1 and 2 self/parent response discrepancies

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C. Study Limitations

CONTEXTUAL FACTORS

- COVID-19 history effect
  - Forced sessions to occur via telehealth
  - Participant remote learning fatigue
  - Influenced Participant 1 treatment goal

METHODOLOGICAL FACTORS

- Small sample size
- Limited data points for Participant 2 baseline phase
- Use of self-report measurement

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D. Summary and Clinical Implications

- Empirical and dynamic approach to treatment can be successful
- Benefit of GAS
- Positive response to treatment (TARF-R) results
- Intervention may be better evaluated through a group design (ITS)

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