EVALUATION OF A NARRATIVE LANGUAGE INTERVENTION FOR ADOLESCENTS WITH DOWN SYNDROME

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Dedication

This project is dedicated to all the adolescents and families whom I had the pleasure of meeting. Thank you for your willingness to open your lives and your hearts; I am the better for having met each and every one of you.

Abstract

Purpose: The current study aimed to evaluate the effect of an animated computer-based narrative language intervention on the microstructure and macrostructure narrative language abilities of verbally expressive adolescents with Down syndrome.

Method: This study used an interparticipant, multiple-baseline, single-subject design. Three females with Down syndrome aged 13, 14, and 16 years each with a mean length of utterance (MLU) greater than 2.5 morphemes participated in this study. Study sessions included 4-5 baseline sessions, 12 intervention sessions, and 1 follow-up session. Microstructure narrative elements (Total Number of Utterances, MLU, and number of Bound Morphemes) were analyzed using visual inspection of data points. Treated macrostructure narrative elements (Character, Setting, Initiating Event, and Consequence) as well as one control measure, Initiating Event, were scored using the Index of Narrative Complexity (Petersen, Gillam, & Gillam, 2008) and analyzed using visual inspection of data points, percentage of maximum data points, and Chi-square analysis.

Results: Treatment gains were found on both microstructure and macrostructure narrative measures. However, there was heterogeneity in outcomes across participants, dependent measures, and elicitation contexts.

Conclusion: Based on the limited but positive treatment effects observed in this study, further development and empirical examination of narrative language intervention for adolescents with Down syndrome is warranted.

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Introduction

Down syndrome is the most common genetic cause of intellectual disability with 1 in 691 infants born with Down syndrome in the United States each year (Center for Disease Control and Prevention, 2011). Down syndrome is caused by a gene mutation in which an individual is born with an extra copy of a single chromosome, typically chromosome 21, leading to specific physical features, increased risk of certain health related difficulties, as well as differences in cognitive functioning.

One particular area of weakness for individuals with Down syndrome is speech and language development, including narrative language and discourse abilities. Difficulties with narrative language and discourse skills often make it challenging for adolescents with Down syndrome to effectively communicate past, present, or future events. However, relatively few studies have investigated language interventions designed to impact the ability to express narratives and improve functional communication of everyday events and activities for individuals, particularly adolescents and adults, with Down syndrome. Due to difficulties with narrative language and discourse skills, along with the limited existing empirical evidence regarding appropriate language intervention for adolescents with Down syndrome, the current study aimed to evaluate a narrative language intervention for adolescents with Down syndrome.

Overview of Down Syndrome

Down syndrome is caused by a gene mutation leading to specific physical features and increased risk of certain health related difficulties. Distinctive physical features of individuals with Down syndrome may include a flat face with an upward slant to the eye, small eyes with rounded corners, small ears and mouth, large tongue, small hands and feet, macrochephaly, and hypotonicity (Center for Disease Control and Prevention, 2011). Individuals with Down syndrome often experience increased risk of certain health related difficulties including heart defects, stomach problems such as a blocked intestine or Celiac disease, difficulty feeding and swallowing, recurrent otitis media, impaired hearing and/or vision, endocrine and skeletal difficulties, and a decreased life span (Center for Disease Control and Prevention, 2011).

Individuals with Down syndrome typically demonstrate differences in cognitive functioning as well as difficulties with speech and language development, particularly in the areas of speech production and expressive language. Differences in cognitive functioning of individuals with Down syndrome may include weaknesses in the areas of attention, memory, concentration, and judgment as well as an increased risk of dementia (Center for Disease Control and Prevention, 2011). Individuals with Down syndrome typically experience significant delays in verbal and non-verbal cognitive domains; however, the nature of these delays vary from mild to severe across individuals with Down syndrome (Center for Disease Control and Prevention, 2011). Visual-spatial, visual-cognitive, and simple visual-perceptual abilities appear to be areas of relative

strength for individuals with Down syndrome and are often commensurate with nonverbal mental age (Chapman, 2003; Fidler, Most, & Guiberson, 2005).

Speech production difficulties in individuals with Down syndrome are often due to anatomical differences and neuromotor problems such as hypotonia and motor speech disorders (Kumin, 1996; Leddy, 1999; Rosin & Swift, 1999). These difficulties frequently constrain speech intelligibility and limit expressive language. Children and adolescents with Down syndrome often demonstrate decreased speech intelligibility during connected speech when compared to the production of single words (Kumin, 1996). Thus, as word and sentence length increases, speech intelligibility typically decreases, greatly impacting performance on expressive language tasks such as narrative and discourse activities (Kumin, 1996).

Although individuals with Down syndrome typically display weaknesses in both receptive and expressive language abilities, they typically experience more difficulty in the area of expressive language than in the area of receptive language (Abbeduto et al., 2001; Chapman, 1997; Chapman, Schwartz, & Kay-Raining Bird, 1991). Adolescents with Down syndrome demonstrate particular difficulty in their expressive use of morphology and syntax including use of grammatical word tokens and types (Chapman, 1995, 2003, 2006; Chapman, Seung, Schwartz, & Kay-Raining Bird, 1998; Fowler, 1990; Kumin, 1996). Adolescents with Down syndrome also demonstrate difficulty with expressive vocabulary, lexical diversity, syntactic complexity, and sentence and narrative cohesion (Chapman, 2003, 2006; Chapman, et al., 1998; Kumin, 1996). Difficulties in

these areas often impact narrative language and discourse skills including the ability to depict, sequence, and describe past, present, and future events with adequate detail.

Narrative Language of Adolescents with Down Syndrome

Delays in cognitive and language development in children and adolescents with Down syndrome have significant implications for the development and maintainance of narrative language skills, which are believed to be built on the integration of cognitive and linguisitc abilities as well as social and pragmatic skills (Hemphill, Picardi, & Tager-Flusberg, 1991). Producing a narrative, a spoken account of connected events, involves an understanding of the relationship between events as well as the verbal expression of those events. Narrative development is essential for the continuity of personal memory and encoding of experiences. Narratives provide a primary early form of extended discourse, require productive application of complex syntactic and semantic skills, and use decontextualized language within a functional communicative context. There are two broad categories of narrative measures: microstructure and macrostructure narrative measures (Hughes, MacGillivray, & Schmidek, 1997). Microstructure measures focus on the semantic or syntactic complexity of utterances within a narrative. These measures include lexical and sentence level grammatical measures such as mean length of utterance (MLU) in morphemes, number of clauses per t-unit, and quantity and diversity of vocabulary. Macrostructure measures focus on the overarching coherence and organization of a narrative and include measures such as content, organization, and overall quality. These measures characterize connected text at a global level and reflect

the text as a whole. Both microstructure and macrostructure narrative measures have been studied in the oral narratives of individuals with Down syndrome.

Microstructure. Adolescents with Down syndrome demonstrate difficulty in several areas of microstructure narrative development, including morphology and syntax. Several studies have examined narrative microstructure abilities of adolescents with Down syndrome in comparison to children with typical development. In general, results of these studies have found that when compared to typically developing children matched for non-verbal mental age, individuals with Down syndrome demonstrate reduced linguistic complexity including reduced grammatical accuracy and complexity as well as reduced cohesion (Boudreau & Chapman, 2000; Chapman, et al., 1998; Finestack & Abbeduto, 2010).

Reduced grammatical accuracy and complexity negatively impacts the ability for adolescents with Down syndrome to generate well-structured, easy-to-follow narratives. Finestack and Abbeduto (2010) examined expressive language in adolescents with Down syndrome, adolescents with Fragile X syndrome, and typically developing children matched for nonverbal mental age. A narrative language sample was elicited from each participant using the wordless picture book *Frog Goes to Dinner* and analyzed using Developmental Sentence Scoring (DSS; Lee & Canter, 1971). Results indicated that adolescents with Down syndrome demonstrated reduced grammatical complexity as evidenced by significantly lower DSS Sentence Points and DSS Total Scores than the other two groups.

Keller-Bell and Abbeduto (2007) compared adolescents with Down syndrome to typically developing children matched for nonverbal mental age on a number of microstructure narrative elements including linguistic productivity (i.e., total number of c-units and number of different word roots) and linguistic complexity (i.e., mean length of c-units in words, percentage of grammatically acceptable c-units, number of connections per c-unit, and clause density). Individuals with Down syndrome produced significantly fewer grammatically correct c-units, consistent with other findings indicating expressive language difficulties, particularly in the areas of morphology and syntax, of individuals with Down syndrome.

Chapman, Seung, Schwartz, and Kay-Raining Bird (1998) examined narrative language samples of children and adolescents with Down syndrome and compared microstructure narrative elements such as word types and tokens, mean length of utterance (MLU), and number of bound morphemes to narrative language samples of younger children with typical development matched for nonverbal mental age. For both study groups, narrative samples contained more word types and tokens as well as longer MLUs than did conversational samples. However, results indicated that participants with Down syndrome more frequently omitted words and bound morphemes when compared to younger, typically developing children matched for nonverbal mental age. Importantly, results from this study also indicated continued growth in MLU for the participants with Down syndrome (Chapman, et al., 1998).

On a microstructure level, cohesion includes referential cohesion, or the ability to introduce and maintain reference to characters or objects, as well as temporal and clausal

connectivity, or the ability to mark time and causal relationships. Adolescents with Down syndrome demonstrate difficulty with narrative cohesion such that their narratives are often not well organized and not clearly sequenced. Boudreau and Chapman (2000) compared the narrative production skills of children and adolescents with Down syndrome to the narrative production skills of three groups of typically developing children: (a) typically developing children matched for nonverbal mental age, (b) typically developing children matched for syntax comprehension, and (c) typically developing children matched for expressive language skills. Children and adolescents with Down syndrome produced significantly longer narratives containing more inferences than did their mental age-matched peers; however, the use of cohesive linguistic devices such as referents, pronouns, and conjunctions, was significantly poorer in individuals with Down syndrome than mental age-matched peers.

Results of these studies reveal that adolescents with Down syndrome demonstrate decreased narrative microstructure skills when compared to typically developing children; however, exceptions to these results exist. One such exception includes a study completed by Bird, Cleave, White, Pike, and Helmkay (2008) which examined a number of microstructure narrative measures including mean length of utterance (MLU) in morphemes, number of different words, number of t-units, and number of total words in the narratives of school-aged and adolescent individuals with Down syndrome compared to typically developing individuals matched for reading ability (age equivalents 5;0–9;7 for both groups). Oral, handwritten, and word-processed narratives were elicited using sequenced picture stimuli. Similar to other studies (Boudreau & Chapman, 2000;

Chapman, et al., 1998), significant between-group differences were found on measures of length, with individuals with Down syndrome using longer narratives. Significant differences were not found on other microstructure measures, including number of different words, number of t-units, and number of total words. Microstructure narrative abilities of individuals with Down syndrome were comparable to those of typically developing controls matched for reading ability; however, microstructure narrative abilities of individuals with Down syndrome were not age-appropriate, indicating narrative deficits relative to chronologically age-matched peers.

Although results of studies examining the narrative microstructure skills of adolescents with Down syndrome are mixed, it is clear that adolescents with Down syndrome are performing below chronological age-expectations and, in many cases, nonverbal mental age expectations on measures such as mean length of utterance (MLU), grammatical accuracy and complexity, and cohesion (Boudreau & Chapman, 2000; Chapman, et al., 1998; Finestack & Abbeduto, 2010). Due to performance below chronological and mental-age expectations as well as the importance of narrative language skills in the ability to retell life events, these narrative elements should be targeted in language interventions for adolescents with Down syndrome.

Macrostructure. Several studies have examined narrative macrostructure skills of adolescents with Down syndrome in comparison to children with typical development. In general, results of these studies have found that, when compared to typically developing children matched for nonverbal mental age, individuals with Down syndrome

demonstrate difficulty in macrostructure narrative development including episodic structure, story grammar components, plotline, and inferences.

Adolescents with Down syndrome demonstrate difficulty generating full sequenced narratives. They often fail to include key narrative elements such as an introduction or a setting, episode(s), and a resolution or conclusion. To this point, in their study of narrative production of children and adolescents with Down syndrome, Bird, Cleave, White, Pike, and Helmkay (2008), completed macrostructure narrative episodic structure analyses. Specifically, they calculated the number of pictured episodic components included in each narrative. Results indicated no significant between group differences in macrostructure narrative abilities of individuals with Down syndrome when compared to typically developing controls matched for reading abilities; however, individuals with Down syndrome demonstrated reduced episodic components relative to chronological age expectations, indicating deficits in episodic structure of macrostructure narrative language.

Keller-Bell and Abbeduto (2007) compared macrostructure narrative elements including mental state verbs, character name, character dialogue, repetition, onomatopoeia, fantasy or exaggeration, evaluation density, and evaluation diversity of adolescents with Down syndrome, adolescents with Fragile X syndrome matched for cognitive age, and typically developing children matched for nonverbal mental age. Individuals with Down syndrome were found to use more onomatopoeia and exclamations as well as a higher variety of evaluative devices than typically developing children matched for nonverbal mental age. However, individuals with Down syndrome

demonstrated difficulty using mental state verbs. It is important to note that individuals with Down syndrome performed well below chronological age expectations on all macrostructure narrative measures indicating deficits in narrative production relative to chronologically age-matched peers.

Miles and Chapman (2002) analyzed narrative themes and plotlines produced by adolescents and adults with Down syndrome. Results indicated that the individuals with Down syndrome included more instances of story theme and plotline as well as more misadventures of a protagonist than did a group of children with typical development matched for mean length of utterance (MLU). The participants with Down syndrome demonstrated reduced macrostructure skills compared to typically developing children matched for nonverbal mental age; however, these group differences did not reach statistical significance.

Inferencing is the process of deriving a consequence from a given set of facts or statements. In a study completed by Boudreau and Chapman (2000), children and adolescents with Down syndrome were compared to typically developing children matched for nonverbal mental age, typically developing children matched for syntax comprehension, and typically developing children matched for expressive language in the area of narrative production. Children with Down syndrome produced significantly longer narratives containing more inferences regarding events and the representation of those events than did their mental age-matched peers.

Although results of studies examining the narrative macrostructure skills of adolescents with Down syndrome are mixed, it is clear that adolescents with Down

syndrome are performing below chronological age expectations and, in many cases, below nonverbal mental age expectations on measures such as episodic structure, story grammar components, and plotline. Due to performance below chronological and mental age expectations as well as the importance of narrative language skills in the ability to retell life events, these narrative elements should be targeted in language interventions for adolescents with Down syndrome.

Language Intervention in Down syndrome

Although children, adolescents, and adults with Down syndrome typically demonstrate significant delays or deviations in expressive language abilities, little empirical evidence exists regarding appropriate language intervention programs for individuals with Down syndrome. This is especially the case for school-aged and adolescent individuals who are likely to benefit from intervention focused on narrative language skills.

The only study that has specifically examined use of a language intervention for older individuals with Down syndrome targeted grammatical language (Hewitt, Hinkle, & Miccio, 2005). This study included three adults with Down syndrome aged 29, 37, and 52 years. Each of the three participants completed a 12 session intervention cycle targeting specific grammatical morphemes. The intervention consisted of a combination of both naturalistic intervention contexts (i.e., conversation) and structured procedures for elicitation of targets (i.e., prompts, recasts, models). All three participants experienced increases in their use of target grammatical morphemes, indicating that the hybrid

intervention approach may be effective in improving grammatical morphemes in individuals with Down syndrome.

Given the lack of empirical evidence regarding appropriate language intervention programs for school-aged and adolescent individuals with Down syndrome who are likely to benefit from intervention focused on narrative language skills, it is important to review previous investigations examining the use of narrative language interventions for other populations.

Narrative Language Intervention in Other Populations

In general, studies of children with language impairment have found that narrative language interventions may lead to improvements in both microstructure and macrostructure narrative elements. For example, Petersen, Gillam, Spencer, and Gillam (2010) used a multiple baseline design to examine the effects of narrative intervention on microstructure and macrostructure narrative elements in three children ages 6, 7, and 8 years with neuromuscular impairment and mixed expressive/receptive language impairment. This study used models as well as verbal and visual supports to guide story retell abilities. Supports were gradually withdrawn until participants were able to retell a story independently at the conclusion of the intervention. Results indicated statistically significant differences in story grammar components as well as the ability to narrate complete episodes when comparing pre- and post-intervention phases.

In another study, Swanson, Fey, Mills, and Hood (2005) examined children with specific language impairment aged 7 to 8 years enrolled in a six-week feasibility study for narrative-based language intervention. Intervention sessions targeted sentence form as

well as story form and content using story retell and story generation tasks. Results indicated that 8 of the 10 participants demonstrated clinically significant improvement on sentence form as well as story form and content following the six-week intervention cycle.

Fey, Finestack, Gajewski, Popescu, and Lewine (2010) randomly assigned children with language impairment to one of three intervention cycles that combined a traditional narrative-based intervention with the computer-based Fast ForWord-Language (Fey, et al., 2010) intervention. Following the first 5-week study period, the groups that received intervention, combined, demonstrated significant differences from the no-treatment group on mean main verb score and mean conjunctions per sentence. Following all cycles of intervention, all three groups demonstrated significant effects on narrative ability as measured by the Narrative Language Ability Indices of the Test of Narrative Language; however, no significant between-group effects of intervention were noted.

Davies, Shanks, and Davies (2004) examined the use of a narrative language intervention involving story grammar approach in 34 school-aged children with delayed language development This intervention utilized collaboration between teachers, learning support assistants, and speech and language pathologists. Results indicated significant improvement in the macrostructure narrative component of sequencing following narrative language intervention.

These studies indicate that narrative language intervention can significantly impact microstructure and macrostructure narrative abilities in individuals with language impairment. Individuals with Down syndrome typically experience difficulties in

receptive and expressive language including both microstructure and macrostructure narrative elements. Few studies exist which examine language intervention in individuals with Down syndrome, particularly adolescents and adults with Down syndrome, who are likely to benefit from narrative language intervention. It is unknown how adolescents with Down syndrome would respond to narrative interventions similar to those that have been successfully used in other populations. However, given the weaknesses in microstructure and macrostructure abilities of adolescents with Down syndrome, these approaches seem worthwhile. The current study aimed to examine the effects of a computer-based narrative language intervention on the microstructure and macrostructure narrative abilities of adolescents with Down syndrome.

Current Study

This study aimed to examine the efficacy of a computer-based narrative language intervention focused on microstructure and macrostructure narrative elements in adolescents with Down syndrome. Specifically, this study was designed to answer the following questions:

1. Does a computer-based narrative language intervention lead to increases in microstructure language ability based on total number of utterances, mean length of utterance (MLU) in morphemes, and number of bound morphemes?
2. Does a computer-based narrative language intervention lead to increases in macrostructure language ability based on measures of story grammar components including character, setting, initiating event, and consequence?

Based on previous findings, it was predicted that untreated microstructure elements such as total number of utterances, MLU, and number of bound morphemes would increase during and following intervention. It was also predicted that macrostructure narrative elements targeted during intervention sessions would increase during and following intervention as measured by the Index of Narrative Complexity (INC; Petersen, et al., 2008) with no significant differences seen in macrostructure narrative elements not targeted during intervention sessions.

Method

Prior to initiating this project, the study was approved by the Institutional Review Board (IRB) of the University of Minnesota, Twin Cities. Parental consent to child participation and assent from the adolescent participants with Down syndrome was obtained both verbally as well as in writing before the initiation of data collection.

Participants

Five adolescents with Down syndrome due to Trisomy 21 participated in this study. Each of the five participants qualified for and participated in data collection; however, two participants were excluded from data analyses. One of these participants (male, age 13 years 6 months) was excluded due to intermittent attendance and completion of only half of the intervention sessions. The other of these participants (male, age 17 years 2 months) was excluded due to extremely poor intelligibility in connected speech which prohibited reliable analyses of his language transcripts. Thus, a total of three adolescent females (ages 16 years 3 months, 13 years 11 months, and 14

years 11 months) completed all study sessions and were included in data analyses for the present study. See Table 1 for summary of participant demographic information.

Table 1

Summary of Participant Demographic Information

	Participant		
	DS1	**DS2**	**DS3**
Gender	Female	Female	Female
Age	16;3	13;7	14;8
Race/Ethnicity and Languages Spoken	Non-Hispanic/Latino, White, European-American who spoke only English.	African-American and white, European-American who spoke only English.	Non-Hispanic/Latino, White, European-American who spoke only English.
Household	2 parent/guardian household with 2 other children	2 parent/guardian household with no other children	2 parent/guardian household with 1 other child
Combined Annual Household Income	$100,001-$150,000	>$150,000	$50,001-$100,000
Maternal Education	1 year of college or technical school education	Graduated college with an Associates/ Technical degree	Graduated college with a B.A. or B.S.
Paternal Education	Graduated college with a B.A. or B.S.	Graduated college with a B.A. or B.S.	Graduated college with a B.A. or B.S.
Speech-Language Services	Continuously receiving services for 16 years	Continuously receiving services for 12 years	Continuously receiving services for 12 years

Participants were recruited through an advertisement placed in *Special Times*, the newsletter of the Down Syndrome Association of Minnesota, Volume 25 No. 5. Parents interested in the study contacted Dr. Lizbeth Finestack. Dr. Finestack provided parents

with details regarding the study and asked parents for information regarding the language development of their child to help ensure appropriate candidacy for the treatment under investigation. Parents and their children who appeared to be appropriate candidates for the narrative language intervention were invited to the Department of Speech-Language-Hearing Sciences at the University of Minnesota for an initial evaluation. The initial testing was designed to confirm the appropriateness of study inclusion.

To be included in the study, participants had to meet the following requirements: (a) expressively combining words as measured by an initial language sample (MLU > 2.5 morphemes); (b) hearing threshold better than or equal to 30 dB in at least one ear (aided or unaided) as measured by a hearing screening; (c) nonverbal mental age equivalent greater than or equal to 3 years, 6 months as measured by the Developmental Ability Scoring, Second Edition (DAS-II; Elliott, 2007); and (d) adequate speech intelligibility as measured by the Sounds in Words subtest of the Goldman-Fristoe Test of Articulation, Second Edition (GFTA-II; Goldman & Fristoe, 2000).

Initial Evaluation Procedures

Examiners consisted of two graduate-level students in Speech-Language Pathology and one certified Speech-Language Pathologist. Examiners for the initial evaluations were assigned to participants based on schedule availability. Because the initial evaluation for each participant was completed across two sessions, participants may have had more than one initial examiner.

As part of an initial evaluation, parents completed a demographic questionnaire. Child participants completed a conversational language sample, a hearing screening, the

Developmental Ability Scoring, Second Edition (DAS-II; Elliott, 2007), and the Goldman-Fristoe Test of Articulation, Second Edition (GFTA-II; Goldman & Fristoe, 2000). These assessments were used to determine study eligibility. As part of a second, follow-up evaluation, participants completed the Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF-IV; Semel, Wiig, & Secord, 2003), the Test of Narrative Language (TNL; Gillam & Pearson, 2004), and the Woodcock Reading Mastery Tests, Revised (WRMT-R; Woodcock, 1999). These assessments were used to further evaluate and characterize the language and reading abilities of the participants. Each of the evaluation sessions required no more than 1.5 hours and were held within one week of one another. Age equivalent scores were reported due to the discrepancies observed between chronological age and non-verbal mental age of older individuals with Down syndrome. See Table 2 for summary of assessment scores obtained during initial evaluation.

Table 2

Summary of Assessment Scores Obtained During Initial Evaluation

	Participant		
	DS1	**DS2**	**DS3**
Conversational Language Sample			
Sample Time	22:24	17:38	29:45
Number of Utterances	314	258	321
MLU in Morphemes	5.36	4.89	2.61
Total Number of Words	1562	1187	769
Number of Different Words	440	288	307
Bound Morphemes	120	74	69
Nonverbal Cognition[a]			
Picture Simulation Raw Score (AE)	9 (5;10)	14 (5;7)	12 (5;1)
Pattern Construction Raw Score (AE)	21 (6;7)	23 (5;4)	7 (3;1)
Matrices Raw Score (AE)	6 (4;4)	8 (5;10)	4 (<3;7)
Average of Non-verbal Age Equivalents	5;7	5;7	3;11
Articulation[b]			
Raw Score (AE)	9 (4;7)	13 (4;2)	5 (5;3)
Global Language[c]			
Concepts and Directions Raw Score (AE)	3 (<4;0)	2 (>4;0)	5 (4;2)
Word Structure Raw Score (AE)	17 (5;2)	0 (<3;2)	8 (4;2)
Recalling Sentences Raw Score (AE)	8 (4;3)	0 (<3;2)	0 (<4;0)
Formulated Sentences Raw Score (AE)	4 (4;6)	0 (<3;2)	0 (<4;0)
Narrative Language[d]			
Narrative Comprehension Raw Score (AE)	23 (5;11)	4 (<4;7)	7 (<4;7)
Oral Narration Raw Score (AE)	15 (<4;7)	6 (<4;7)	5 (<4;7)
Reading[e]			
Readiness Cluster AE	5;8	7;4	6;7
Basic Skills Cluster AE	7;3	7;11	8;0
Reading Comprehension AE	7;0	6;6	7;3

[a]Measured by the Differential Ability Scales, Second Edition; [b]Measured by the Goldman-Fristoe Test of Articulation, Second Edition; [c]Measured by the Clinical Evaluation of Language Fundamentals, Fourth Edition; [d]Measured by the Test of Narrative Language; [e]Measured by the Woodcock Reading Mastery Test, Revised.

Demographic Questionnaire. The mother of each participant completed a demographic questionnaire. Demographic information was collected to ascertain personal

characteristics of each participant including age, gender, diagnosis, medical history, past and current rehabilitation and special education services, socioeconomic status, and family life.

Conversational Language Sample. A conversational language sample was collected to calculate mean length of utterance (MLU) in morphemes. To be included in the study, participants were required to be combining words (MLU > 2.5 morphemes) based on the initial conversational language sample. Topics of interest such as school, teachers, pets, sports, games, friends, interests, vacations, and hobbies were used to elicit conversation from participants. The language sampling guidelines used were developed from Leadholm and Miller (Leadholm & Miller, 1995).

Hearing Screening. A hearing screening was completed to ensure that the participants had no greater than a mild hearing loss. To be included in the study, participants were required to detect a 30 dB tone at 1000, 2000, and 4000 Hz. Alternatively, participants needed to demonstrate consistent use of appropriate hearing aids. Normal hearing was not required for participation due to the high rate of hearing impairment in individuals with Down syndrome (Kile, 1996; Roizen, Wolters, Nicol, & Blondis, 1993). Participants DS1 and DS2 passed the hearing screening. Participant DS3 used bilateral hearing aids.

The Differential Ability Scales, Second Edition. The Differential Ability Scales, Second Edition (DAS-II; Elliott, 2007) was completed to determine an average nonverbal mental age equivalent. An average nonverbal mental age equivalent was calculated by adding age equivalent scores of each of the 3 nonverbal subtests of the DAS-II and

dividing by the number of subtests (i.e., 3). To be included in the study, participants were required to have an average nonverbal mental age equivalent greater than 3 years, 6 months. The DAS-II is a comprehensive, norm-referenced, standardized evaluation tool used to assess cognitive abilities important to learning. Subtests of the DAS-II measure a variety of cognitive abilities including verbal and visual working memory, immediate and delayed recall, visual recognition and matching, processing and naming speed, phonological processing, and understanding of basic number concepts.

The Goldman-Fristoe Test of Articulation, Second Edition. The Sounds-in-Words subtest of the Goldman-Fristoe Test of Articulation, Second Edition (GFTA-II; Goldman & Fristoe, 2000) was completed to determine production accuracy of consonant sounds of Standard American English at the single word level to assist in evaluating speech intelligibility. To be included in the study, participants were required to have an age equivalent score of at least 3 years, 6 months. The GFTA-II is a norm-referenced, standardized assessment tool used to measure articulation of consonant sounds found in Standard American English at different levels of complexity including sounds in words, sounds in sentences, and stimulability.

The Clinical Evaluation of Language Fundamentals, Fourth Edition. The Clinical Evaluation of Language Fundamentals, Fourth Edition (CELF-IV; Semel, et al., 2003) was completed to assess core language skills prior to intervention. The CELF-IV is a comprehensive, norm-referenced, standardized language assessment tool which measures expressive and receptive language through subtests such as Concepts and Following Directions, Word Structure, Recalling Sentences, and Formulated Sentences.

The Test of Narrative Language. The Test of Narrative Language (TNL; Gillam & Pearson, 2004) was completed to assess narrative language skills prior to intervention. The TNL is a norm-referenced, standardized assessment tool used to assess narrative comprehension and oral narration skills through tasks containing no picture cues, sequenced picture cues, and single picture cues.

The Woodcock Reading Mastery Test, Revised Edition. The Woodcock Reading Mastery Test, Revised (WRMT-R; Woodcock, 1999) was completed to assess each participants current reading abilities prior to intervention. The WRMT-R is a norm-referenced, standardized assessment tool used to assess reading in the areas of readiness, basic skills, and comprehension. Subtests of the WRMT-R measure a variety of reading skills including visual-auditory learning, letter identification, word identification, word attack, word comprehension (antonyms, synonyms, analogies), and passage comprehension.

Procedures

All participants completed 4-5 baseline sessions and 12 intervention sessions. All participants completed the baseline and intervention sessions concurrently and within the same timeframe. Baseline sessions were completed at a rate of one session per week spread across 4 weeks and intervention sessions were completed at a rate of two sessions per week spread across 6 weeks. A graduate student in Speech-Language Pathology (study author) served as the clinician for all baseline and treatment sessions for all participants. A second graduate level student in Speech-Language Pathology was trained in baseline and intervention procedures should a second clinician become necessary due

to scheduling conflicts or illness. This second clinician attended and participated in one baseline session and one intervention session with a single participant to maintain skills in baseline and intervention procedures; however, the second clinician was never needed.

Baseline

Three activities were completed during each baseline session. The first activity was a story retell task in which each participant was shown a single picture, told a story, and asked to retell the story to the clinician using as much detail as possible. The second activity was a novel story generation task using a sequence of four or six sequential pictures. The participant was asked to tell the story shown in the pictures using as much detail as possible. The third activity was a novel story generation task using a single, complex picture. The participant was asked to tell the story shown in the picture using as much detail as possible.

A total of 20 unique picture packets were created comprising one picture for story retell, one set of sequenced pictures for story generation, and one scene picture for story generation. Each of the baseline and intervention sessions were randomly assigned one picture packet. These picture packets were used for narrative language sample collection during each baseline and intervention session.

Intervention

Intervention Goals. Over the course of the study, the clinician targeted three story grammar goals which were derived from the scoring categories of Index of Narrative Complexity (INC; Petersen, et al., 2008). Goal 1 focused on the development of the narrative measures Character and Setting. The narrative measure Character was

described as a person or animal within a story; the narrative measure Setting was described as a time or location within a story. Goal 2 focused on the development of the narrative measure Initiating Event. The narrative measure Initiating Event or Problem was described as an event that makes a character do or feel something. Goal 3 focused on the development of the narrative measure Consequence. The narrative measure Consequence was described as an event caused by something a character does. One narrative category from the INC, Internal Response, was used as a control category to determine if narrative performance changed on untreated categories. Internal Response included character emotional or cognitive reactions to Initiating Events. Specific examples of each goal were provided during intervention procedures. Each goal was explicitly presented 8 to 10 times with a mean of 9.4 times during each intervention session. The three goals were targeted using a cyclical approach such that Intervention Sessions 1 through 4 targeted Goal 1, Intervention Sessions 5 through 8 targeted Goal 2, and Intervention Sessions 9 through 12 targeted Goal 3.

Intervention Procedures. The narrative goals were targeted using a computer-based intervention. This intervention was facilitated by the commercially available software entitled Team up with Timo: Stories (Timo; Animated Speech Corporation, 2010). Timo is an interactive computer program that utilizes a narrative-based language intervention to provide opportunities for increasing performance in the areas of story comprehension, narrative skills, social thinking, listening, and answering questions. Timo consists of a total of nine activities including a story read through, a second story read through containing accompanying comprehension questions, a picture sequencing task,

and six games involving various interactive language tasks. The associated games focus on skills related to receptive vocabulary and definitions, categories, associations, exclusions, descriptions, problem solving, and predicting mental states. There are six different scaffolded stories available.

Timo is led by an animated tutor that was designed using the animation characteristics of Baldi, an animated speech synthesis program (Massaro, 2003). In a study by Bosseler and Massaro (2003), Baldi was shown to be effective in teaching new vocabulary words to young individuals with autism. Design features of Timo are based on principles of narrative-based language intervention (Finestack, Fey, Sokol, Ambrose, & Swanson, 2006) which combine naturalistic activities, such as storytelling, with structured, skill-based activities that focus on the underlying language impairments of the individual (Davies, et al., 2004; Swanson, et al., 2005).

In the current study, Timo activities were incorporated into each intervention session including story read-through, story read-through with comprehension questions, story picture sequencing and story retell (story scramble), and six vocabulary and syntax building games. The target goal was discussed a total of ten times throughout intervention including during an introduction, the story read-through, the story read-through with comprehension questions, the story picture sequencing and story retell (story scramble), and once during each of the six vocabulary building games. Discussion of each target goal included the title of the target goal (i.e., Character), a detailed description of the target goal (i.e., A character is a person or an animal in a story. A story might have more than one character. It is important to be specific when talking about a

character and call each character by a name.), and a specific example of the target goal (i.e., The story we are going to read today has a character named [INSERT CHARACTER].).

Following completion of all Timo activities, each intervention session concluded with the same story generation activities completed during each baseline session: story retell, novel story generation using sequenced pictures, and novel story generation using a scene picture.

Follow-up Procedures

Within 1 week of completion of the 12 intervention sessions, each participant attended a single follow-up session. The follow-up session took place at the University of Minnesota, Twin Cities with one of the pre-testing clinicians who was unfamiliar to the participant. Examiners for the follow-up evaluation were chosen based on schedule availability as well as based on previous client knowledge. For example, if a clinician completed the initial language sample collection with a participant that same examiner could not complete follow-up language sample collection with that same participant. During this follow-up session, each participant completed baseline procedures including story retell, sequenced picture story generation, and scene picture story generation. Each participant also completed a follow-up conversational language sample.

Treatment Fidelity

Each treatment session was audio recorded. A total of 20% of all intervention sessions were randomly selected to monitor treatment fidelity. An independent research assistant, who was unaware of the overall study purpose, listened to all randomly selected

files to determine whether intervention procedures were followed. Each file was deindentified in respect to the session number and participant. The assigned listener reviewed each selected intervention session to determine whether the target goal was presented the targeted number of times (i.e., 10) with the appropriate level of detail. Fidelity of treatment ranged from 80-100% with a mean of 94%. In other words, it can be assumed that the target goal was mentioned at least 8 times per intervention session with a mean of 9.4 times per intervention session and a goal of 10 times per intervention session.

Transcription and Coding

Each of the narratives, including the story retell, sequenced picture story generation, and scene picture story generation, obtained during the baseline, intervention, and follow-up sessions were transcribed. Initial transcription was completed by an undergraduate student blinded to participant and session. This student underwent transcription training using Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 2000) guidelines. Training included transcription of three language samples each approximately 40 minutes in length. These training transcripts were compared to transcripts previously transcribed by a trained research assistant to ensure proper use of transcription procedures. Once the assistant completed the initial transcriptions, a second transcriber (study first author) who was not blind to participant and session, listened to all audio samples and marked disagreements on the initial transcripts. The initial blinded transcriber then went back and listened to the audio files a second time and accepted or

rejected the modifications as deemed appropriate. These consensus transcripts served as the final transcripts to be used for data analyses.

Transcription Reliability. A total of 20% (i.e., 31) of all narrative transcripts were randomly selected and transcribed by a third independent blinded transcriber (study second author) for reliability. The third transcriber did not have access to any of the original or consensus transcripts. To determine the amount of error associated with the transcripts, Intraclass Correlation Coefficients (ICCs; Bartko, 1966) were calculated for Total Number of Utterances, Mean Length of Utterance (MLU) in Words, Mean Length of Utterance (MLU) in Morphemes, Total Number of Words, and Total Number of Different Words. ICCs measure the number of differences between the two transcripts to determine the level of variance due to systematic differences between participants as well as differences between transcribers and other unknown sources of error. Using the absolute agreement definition, the ICCs for Total Number of Utterances, MLU in Words, MLU in Morphemes, Total Number of Words, and Total Number of Different Words were high (.95, .91, .90, .96, and .98 respectively). These ICCs indicate that more than 90% of the variance within transcripts could be attributed to systematic differences between participants and less than 10% of the variance could be attributed to the differences between transcribers and other unknown sources of error.

Transcription Coding. Each of the narrative transcripts were coded using the Index of Narrative Complexity (INC; Petersen, et al., 2008). The INC is a criterion-referenced, narrative scoring system designed to monitor progress on macrostructure narrative elements including Character, Setting, Initiating Event, Internal Response, Plan,

Action, Complication, Consequence, Formulaic Markers, Temporal Markers, Causal Adverbial Clauses, Knowledge of Dialogue, and Narrator Evaluations. Previous research findings indicate that the INC can be scored consistently across examiners, that it yields similar scores across various elicitation formats, that it is sensitive to change after intervention, and that it correlates highly with the Test of Narrative Language (TNL; Gillam & Pearson, 2004; Petersen, et al., 2008). For the purposes of this study, scoring guidelines for the INC were modified such that each category included multiple detailed examples to provide more explicit instruction on how to score each narrative measure in a variety of contexts.

A research assistant was trained to use the INC coding system. Training was completed using short (i.e., less than 7 minutes) narrative language transcripts from discarded participant data. The initial set of 10 training transcripts were scored with the lead researcher and any disagreements were discussed. The second set of 10 training transcripts were scored independently, and the research assistant was given immediate feedback by consulting the scores previously assigned by the lead researcher. The third set of 10 training transcripts were scored independently, and the research assistant was given delayed feedback by consulting the scoring of the lead researcher following completion of all 10 transcripts. The fourth and final set of 10 training transcripts were scored independently and compared without any feedback. Reliability between lead researcher and research assistant was 79% for Set 2, 85% for Set 3, and 93% for Set 4. Each of the categories specifically targeted during treatment (i.e., Character, Setting, Initiating Event, and Consequence) received reliability ratings of 80% or higher in Set 4

scoring comparisons. Following successful completion of training files, the study transcripts were independently coded by the trained research assistant who remained blinded to participant and session.

INC Reliability. A total of 21% (i.e., 33) of all narrative transcripts were randomly selected and coded using the INC by the lead researcher for reliability. These transcripts were divided equally among the three tasks (i.e., story retell, sequenced picture story generation, and scene picture story generation). INC reliability was completed using point-by-point analysis. INC reliability between the two coders was 93% across all categories with a range from 62%-100%. A total of 32 out of the 33 files coded for reliability were in at least 84% agreement and 1 out of 33 files was in 62% agreement. Reliability for 12 out of 13 categories from the INC was 80% or higher and reliability for one of the categories (Action) was 76%. Reliability for all categories under investigation (i.e., Character, Setting, Initiating Event, and Consequence) was at least 80%.

Data Entry

All initial and follow-up evaluation scores and INC scores were entered into a database by a research assistant. To ensure that data entry mistakes were minimized, a second research assistant independently re-entered all data into a secondary database. The two databases were compared for differences. Discrepancies were resolved by re-examining the original files.

Microstructure Data Analysis

Due to the discrete nature of the microstructure variables as well as the limited number of data points being analyzed, statistical analyses were not completed as part of microstructure data analyses. Performance on untreated microstructure narrative measures (i.e., Number of Utterances, Mean Length of Utterance, Bound Morphemes) was plotted graphically across all three tasks (i.e., story recall, novel sequenced picture story generation, and novel scene picture story generation) in order to visually inspect the data. To assist the visual inspection, performance on each microstructure measure across the first four sessions was plotted against performance on each measure across the last four sessions. It was anticipated that scores during the final sessions would exceed scores during the first sessions.

Macrostructure Data Analysis

Scores for each of the treated measures (i.e., Character, Setting, Initiating Event, and Consequence), the untreated control measure (i.e., Internal Response), and the Overall INC Scores were analyzed across all three tasks (i.e., story recall, novel sequenced picture story generation, and novel scene picture story generation). Visual inspection, percentage of maximum data points, and Chi-square analyses were calculated and analyzed for each of the three participants.

Visual Inspection. Performance on treated measures (i.e., Character, Setting, Initiating Event, and Consequence), the untreated control measure (i.e., Internal Response), and the Overall INC Scores was plotted graphically across all three tasks (i.e., story recall, novel sequenced picture story generation, and novel scene picture story generation) in order to visually inspect the data. Baseline, Intervention, and Follow-up

stages were marked to enhance the evaluation and interpretation of performance. Sessions occurring prior to initiation of treatment focusing on a particular goal were considered part of the Baseline stage. Sessions occurring during treatment focused on a particular goal were considered part of the Intervention stage. Sessions occurring following cessation of treatment focused on a particular goal were considered part of the Follow-up stage. It was anticipated that scores would remain stable throughout the Baseline stage and increase gradually throughout the Intervention and Follow-up periods. Overall INC Scores were also graphically plotted across all three tasks for visual inspection.

Percentage of Maximum Data points (PMD). Percentage of Maximum Data Points (PMD) was used to compare Baseline, Goal 1 Intervention, Goal 2 Intervention, Goal 3 Intervention, and Follow-up phases. PMD was calculated by determining the number of maximum data points during each phase, dividing by the total number of data points in each phase, and then multiplying by 100. Maximum data points were defined as any data point which had reached the highest available point value in a given category. The maximum data point value for all target and control measures was three with the exception of Setting and Internal Response which both had a maximum data point value of two.

Chi-square Analyses. Pre-treatment, treatment, and post-treatment performance was compared for each of the treated narrative elements (i.e., Character, Setting, Initiating Event, and Consequence), the untreated control narrative element (i.e., Internal Response), and Overall INC Score using Chi-square analyses. Chi-square analyses utilized frequency counts of each INC score for each measure across treatment phases. In

other words, the number of sessions that each point value (i.e., 0, 1, 2, or 3) was obtained served as the dependent measure for the Chi-square analyses for each INC measure. Significant tests were followed by Chi-square analyses which compared each score by each treatment phase. Statistical significance was determined by significance level of .05. Effect sizes were calculated and interpreted using Cohen's standards such that small effect sizes ranged from 0.00-0.49, moderate effect sizes ranged from 0.50-0.79, and large effect sizes were equal to or greater than 0.80.

Results

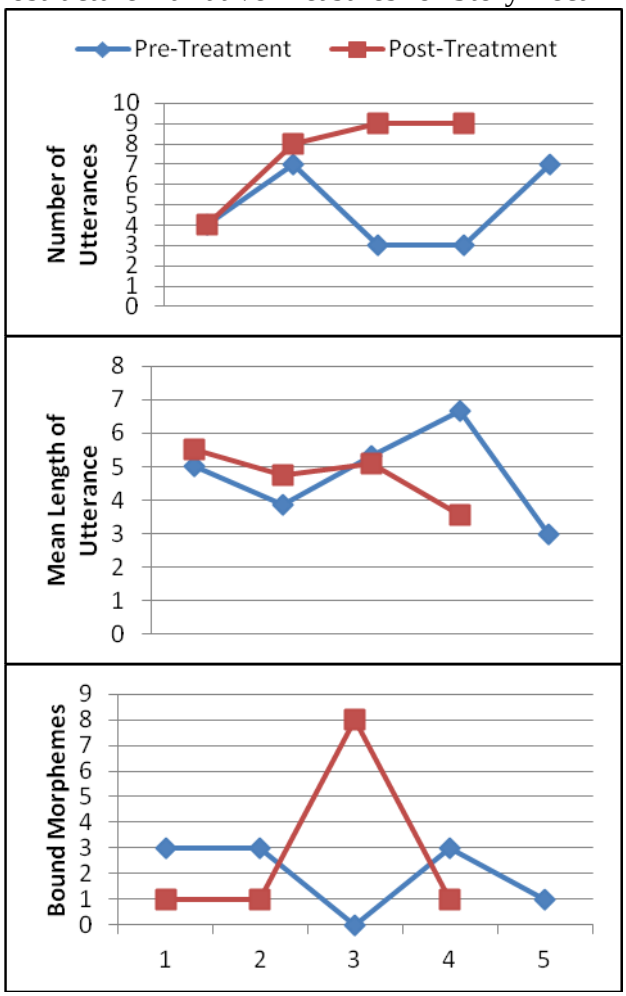
Microstructure Narrative Elements

Participant DS1

Story Recall Tasks. Figure 1 displays values for three microstructure narrative measures (i.e., Number of Utterances, Mean Length of Utterance in Morphemes, Number of Bound Morphemes) for the four pre-treatment sessions and the final four sessions during Story Recall Tasks. Number of Utterances showed a clear visual trend of improvement when comparing initial and final sessions. The remaining untreated microstructure narrative measures did not show visual trend of improvement.

Figure 1

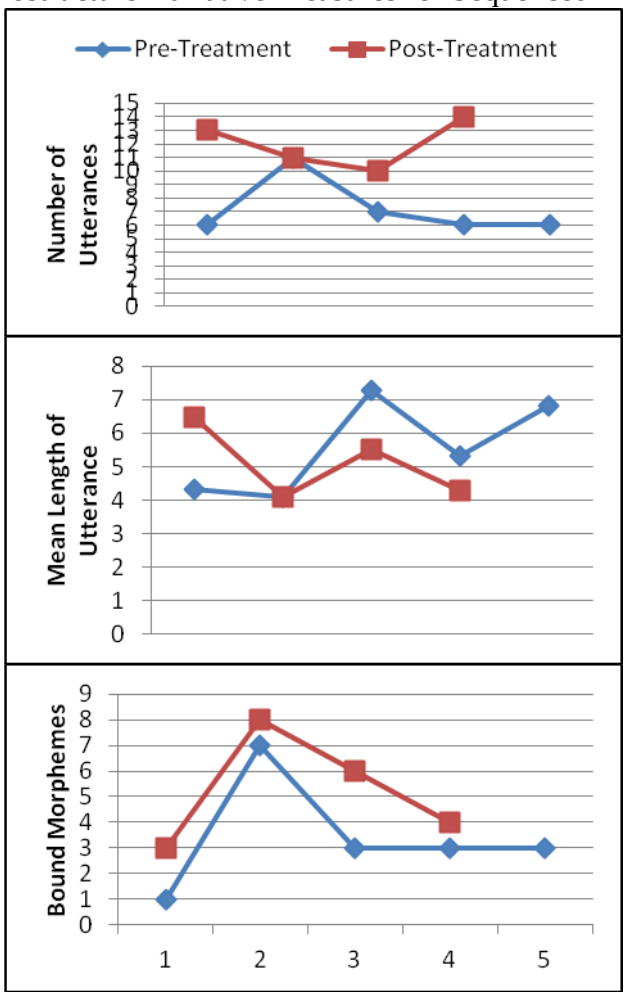
Participant DS1 Microstructure Narrative Measures for Story Recall Tasks



Sequenced Picture Tasks. Figure 2 displays values for the microstructure measures during Sequenced Picture Tasks. Number of Utterances and Bound Morphemes showed a clear visual trend of improvement when comparing treatment phases. The remaining untreated microstructure narrative measure did not show visual trend of improvement.

Figure 2

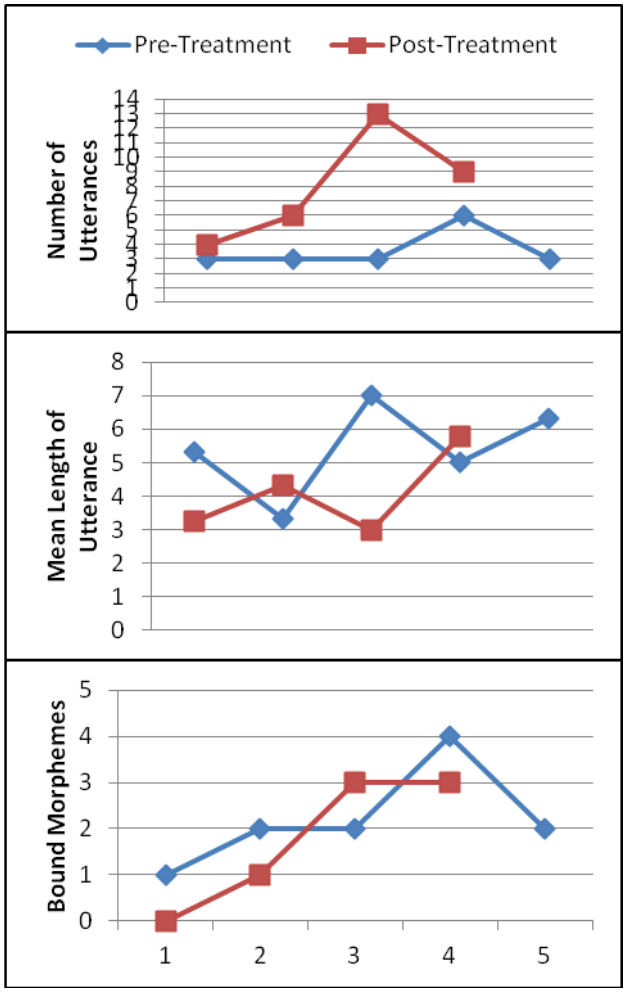
Participant DS1 Microstructure Narrative Measures for Sequenced Picture Tasks



Scene Picture Tasks. Figure 3 displays values for the microstructure narrative measures during Scene Picture Tasks. Number of Utterances showed a clear visual trend of improvement. The remaining untreated microstructure narrative measures did not show visual trend of improvement.

Figure 3

Participant DS1 Microstructure Narrative Measures for Scene Picture Tasks

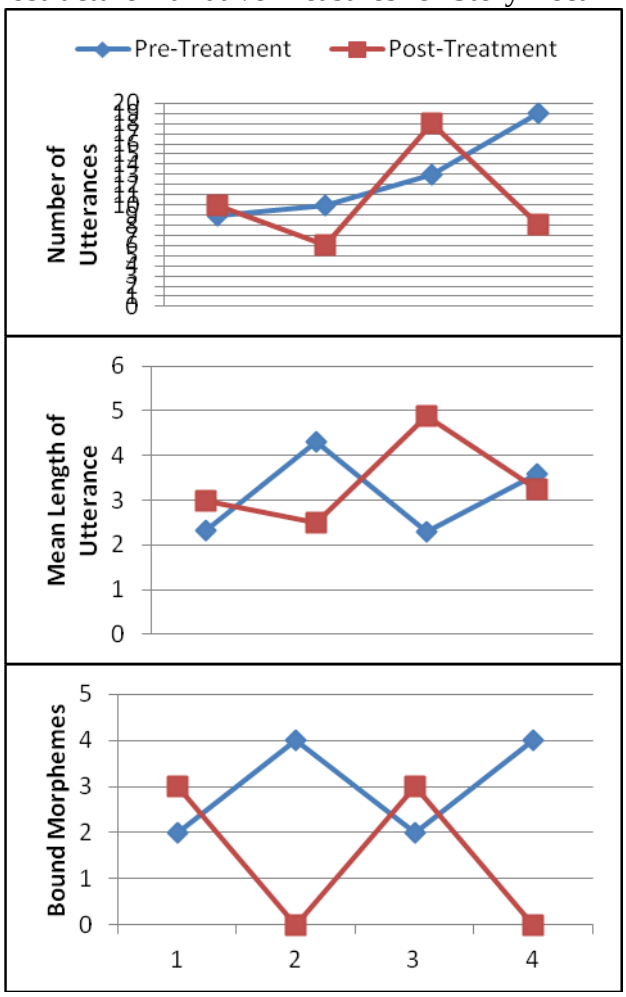


Participant DS2

Story Recall Tasks. Figure 4 displays values for three microstructure narrative measures (i.e., Number of Utterances, Mean Length of Utterance in Morphemes, Number of Bound Morphemes) for the four pre-treatment sessions and the final four sessions during Story Recall Tasks. None of the measures showed a visual trend of improvement.

Figure 4

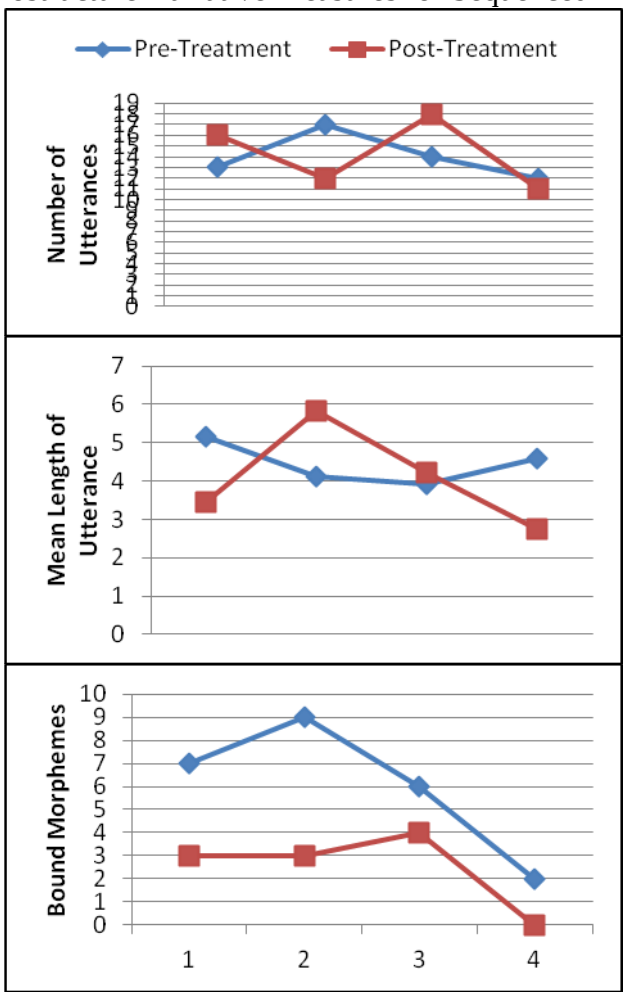
Participant DS2 Microstructure Narrative Measures for Story Recall Tasks



Sequenced Picture Tasks. Figure 5 displays values for the microstructure narrative measures during Sequenced Picture Tasks. None of the measures showed a visual trend of improvement.

Figure 5

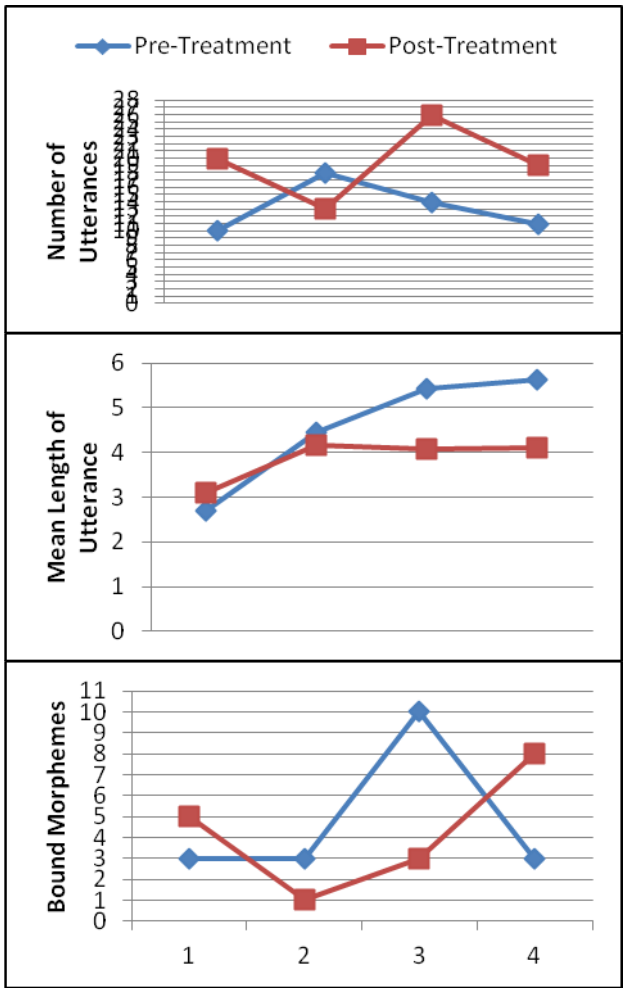
Participant DS2 Microstructure Narrative Measures for Sequenced Picture Tasks



Scene Picture Tasks. Figure 6 displays values for the microstructure narrative measures during Scene Picture Tasks. None of the measures showed a visual trend of improvement.

Figure 6

Participant DS2 Microstructure Narrative Measures for Scene Picture Tasks

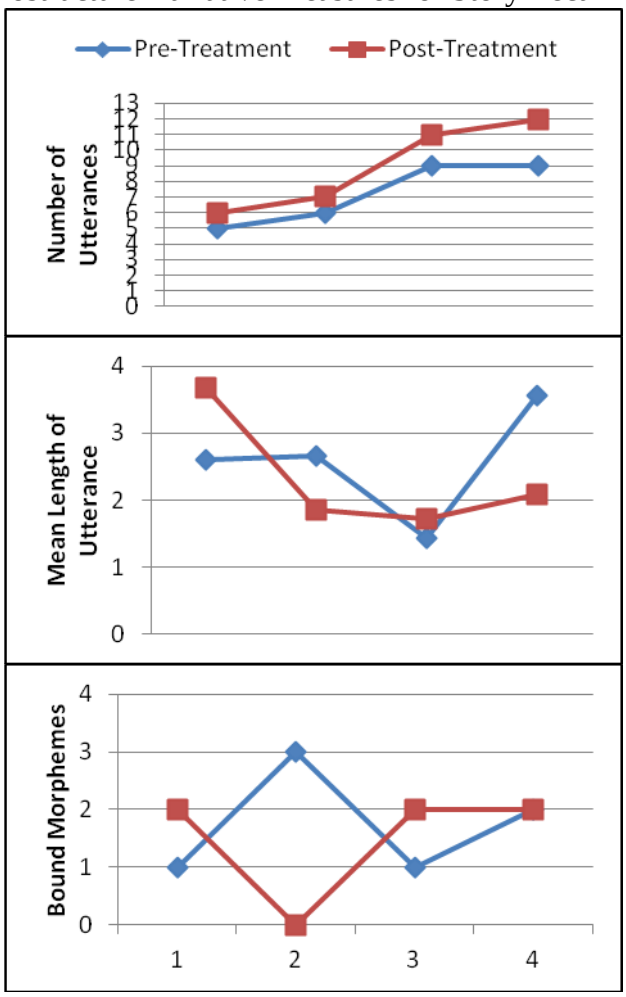


Participant DS3

Story Recall Tasks. Figure 7 displays values for three microstructure narrative measures (i.e., Number of Utterances, Mean Length of Utterance in Morphemes, Number of Bound Morphemes) for the four pre-treatment sessions and the final four sessions during Story Recall Tasks. Number of Utterances showed a clear visual trend of improvement. The remaining untreated microstructure narrative measures did not show a visual trend of improvement.

Figure 7

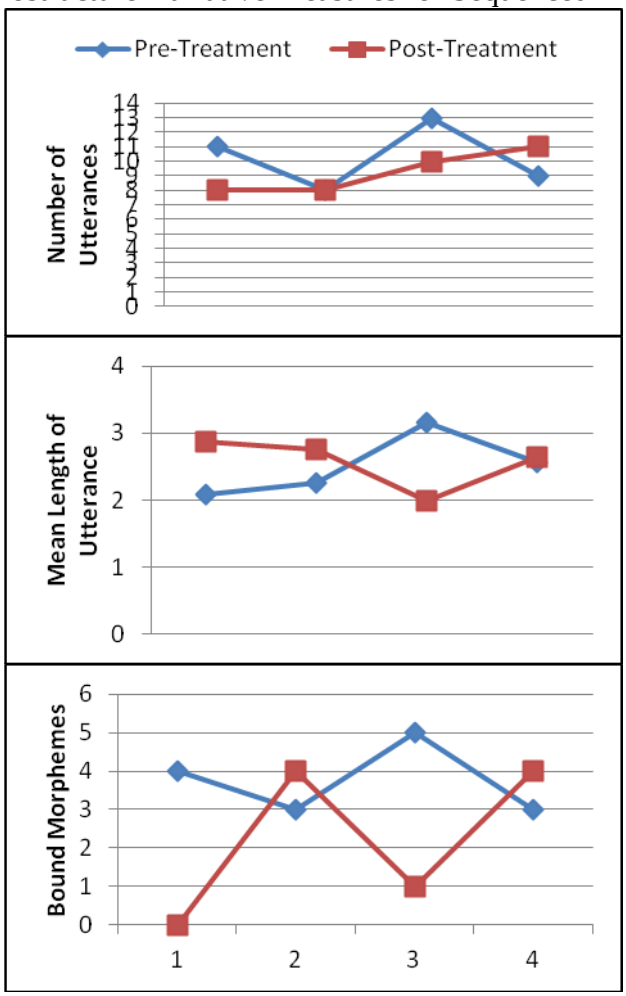
Participant DS3 Microstructure Narrative Measures for Story Recall Tasks



Sequenced Picture Tasks. Figure 8 displays values for the microstructure narrative measures during Sequenced Picture Tasks. None of the microstructure measures showed a visual trend of improvement.

Figure 8

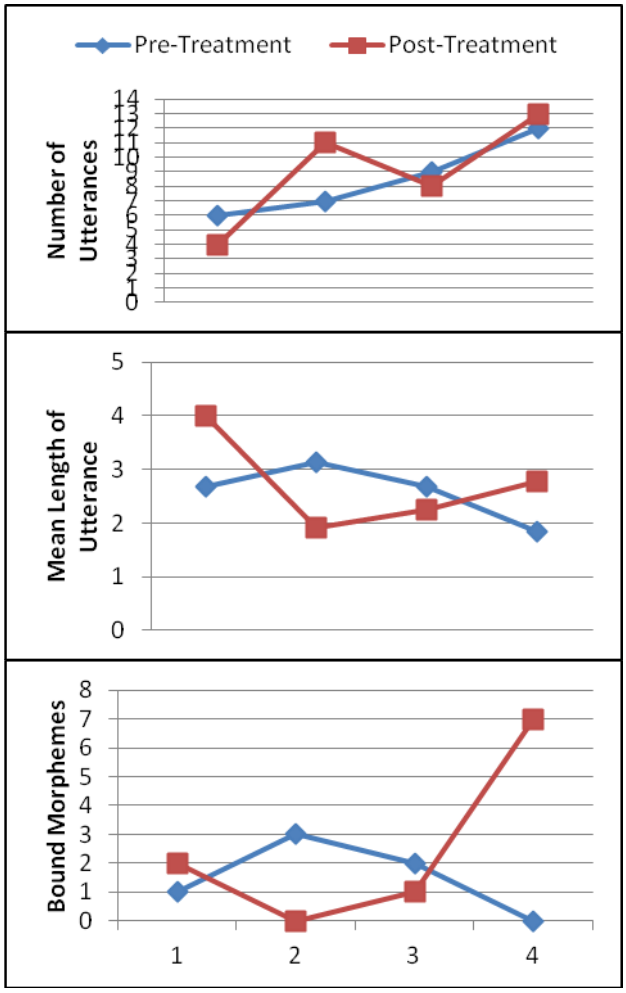
Participant DS3 Microstructure Narrative Measures for Sequenced Picture Tasks



Scene Picture Tasks. Figure 9 displays values for the microstructure narrative measures during the Scene Picture Tasks. None of the microstructure measures showed a clear visual trend of improvement.

Figure 9

Participant DS3 Microstructure Narrative Measures for Scene Picture Tasks



Macrostructure Narrative Elements

Participant DS1

Story Recall Tasks. Figure 10 displays values for each treated narrative measures (i.e., Character, Setting, Initiating Event, Consequence), the untreated control narrative measure (i.e., Internal Response), and overall INC score across pre-treatment, treatment, and post-treatment phases during Story Recall Tasks. The narrative measure Character showed a clear visual trend of increase in the number of maximum data points during the

post-treatment phase when compared to the pre-treatment and treatment phases. The Overall INC Score showed a visual trend of improvement across treatment phases. None of the other treated or untreated measures showed a clear visual trend of improvement during story recall tasks when compared across pre-treatment, treatment, and post-treatment phases.

Figure 10

Participant DS1 Macrostructure Narrative Measures for Story Recall Tasks

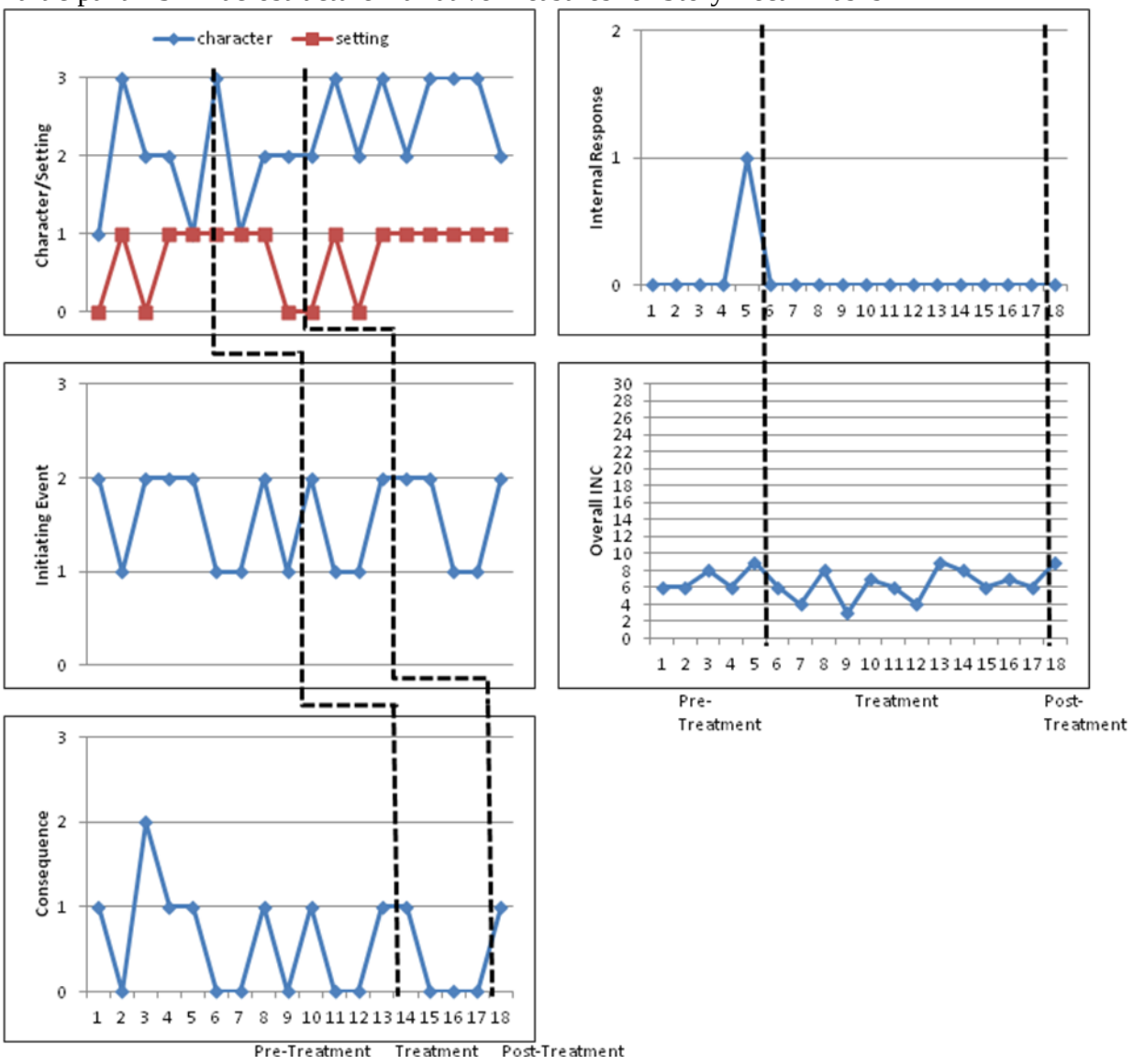


Table 3 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Story Recall Tasks. The PMDs for the narrative measure Character increased across the three study phases. The remaining treated and untreated control measure as well as the overall INC scores showed no increase in PMD during Story Recall Tasks when compared across treatment phases.

Table 3

Participant DS1 Percentage of Maximum Data Points for Story Recall Tasks

Variable	**Pre-Treatment**	**Treatment**	**Post-Treatment**
Character	20	25	55.6
Setting	0	0	0
Initiating Event	0	0	0
Consequence	0	0	0
Internal Response	0	0	0
Overall INC Score	0	0	0

Based on the Chi-square analysis, there were no statistically significant differences in treated measures, untreated measures, or overall INC scores during Story Recall Tasks when compared across pre-treatment, treatment, and post-treatment phases (*p* range = .252 - .956). However, there were moderate effect sizes for the treated narrative measure Character (Φ = .508) and overall INC score (Φ = .685) when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ range = .071-.391).

Sequenced Picture Tasks. Figure 11 displays values for the treated narrative measures, untreated control measure, and overall INC score across pre-treatment, treatment, and post-treatment phases during Sequenced Picture Tasks. The narrative measure Character showed a visual increase in the number of maximum data points during treatment and post-treatment phases when compared to the pre-treatment phase.

The Overall INC Score showed a visual trend of improvement across treatment phases. Remaining measures showed no clear visual trend of improvement.

Figure 11

Participant DS1 Macrostructure Narrative Measures for Sequenced Pictures Tasks

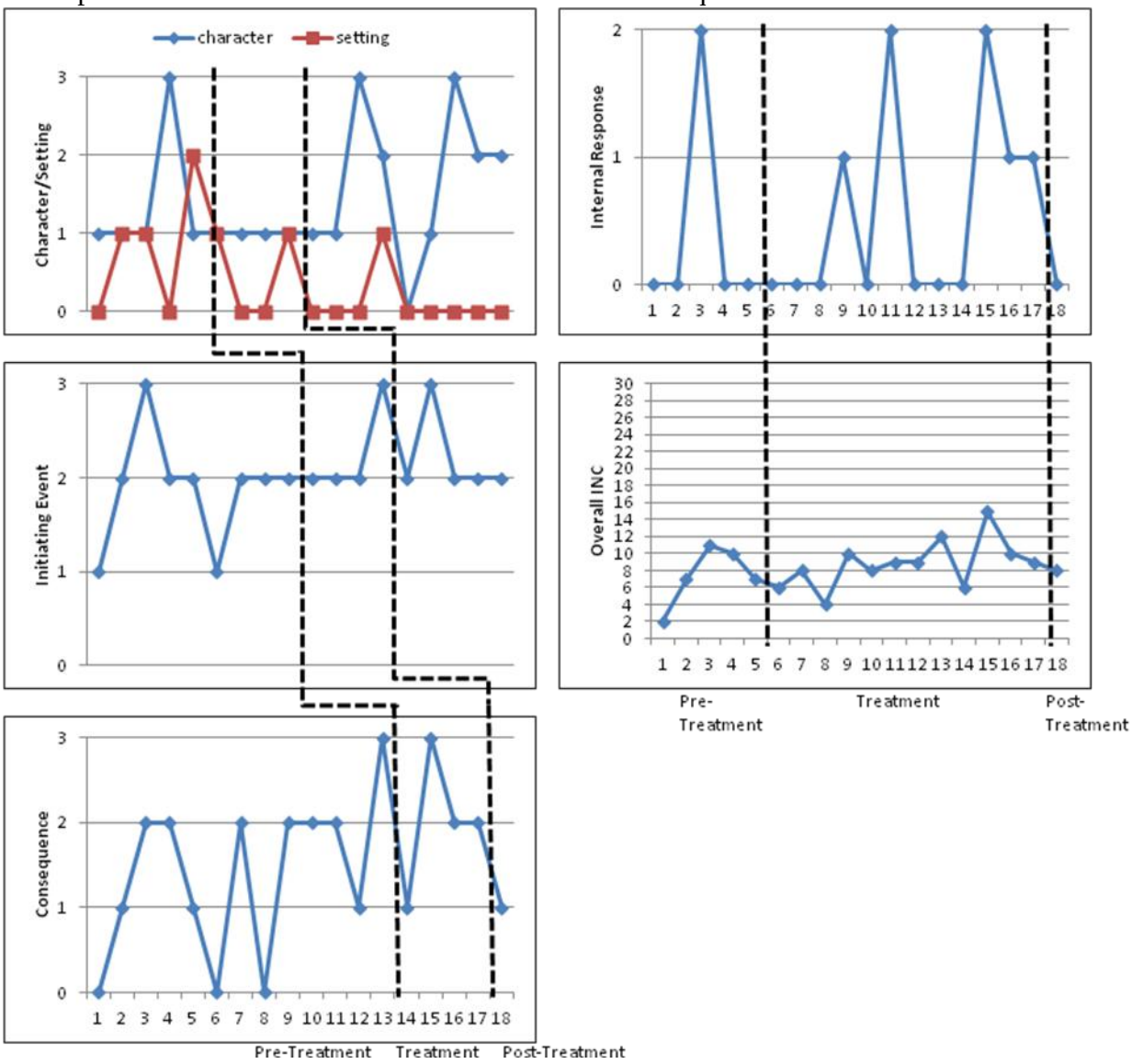


Table 4 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Sequenced Picture Tasks. The PMDs for the narrative measures Character, Initiating Event, and Consequence increased across the three study phases.

The remaining treated and untreated measures as well as the overall INC score showed no increase in PMD during Sequenced Picture Tasks when compared across treatment phases.

Table 4

Participant DS1 Percentage of Maximum Data Points for Sequenced Picture Tasks

Variable	Pre-Treatment	Treatment	Post-Treatment
Character	20	0	22.2
Setting	20	0	0
Initiating Event	11.1	25	20
Consequence	7.7	25	0
Internal Response	20	16.7	0
Overall INC Score	0	0	0

Based on the Chi-square analysis, there were no statistically significant differences in treated measures, untreated control measure, or overall INC scores during Sequenced Picture Tasks when compared across treatment phases (*p* range = .211 - .713). However, there were moderate effect sizes for the treated narrative measures Character (Φ = .636), Setting (Φ = .570), and Consequence (Φ = .504) and a large effect size for overall INC score (Φ = 1.043) when compared across pre-treatment, treatment, and post-treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ = .344-.369).

Scene Picture Tasks. Figure 12 displays values for the treated narrative measures, the untreated control measure, and overall INC score across pre-treatment, treatment, and post-treatment phases during Scene Picture Tasks. The narrative measure Character showed a visual trend of improvement in the post-treatment phase when compared to the pre-treatment and treatment phases. The remaining treated measures, the

untreated measure, and overall INC scores showed no visual trend of improvement during Scene Picture Tasks when compared across treatment phases.

Figure 12

Participant DS1 Macrostructure Narrative Measures for Scene Picture Tasks

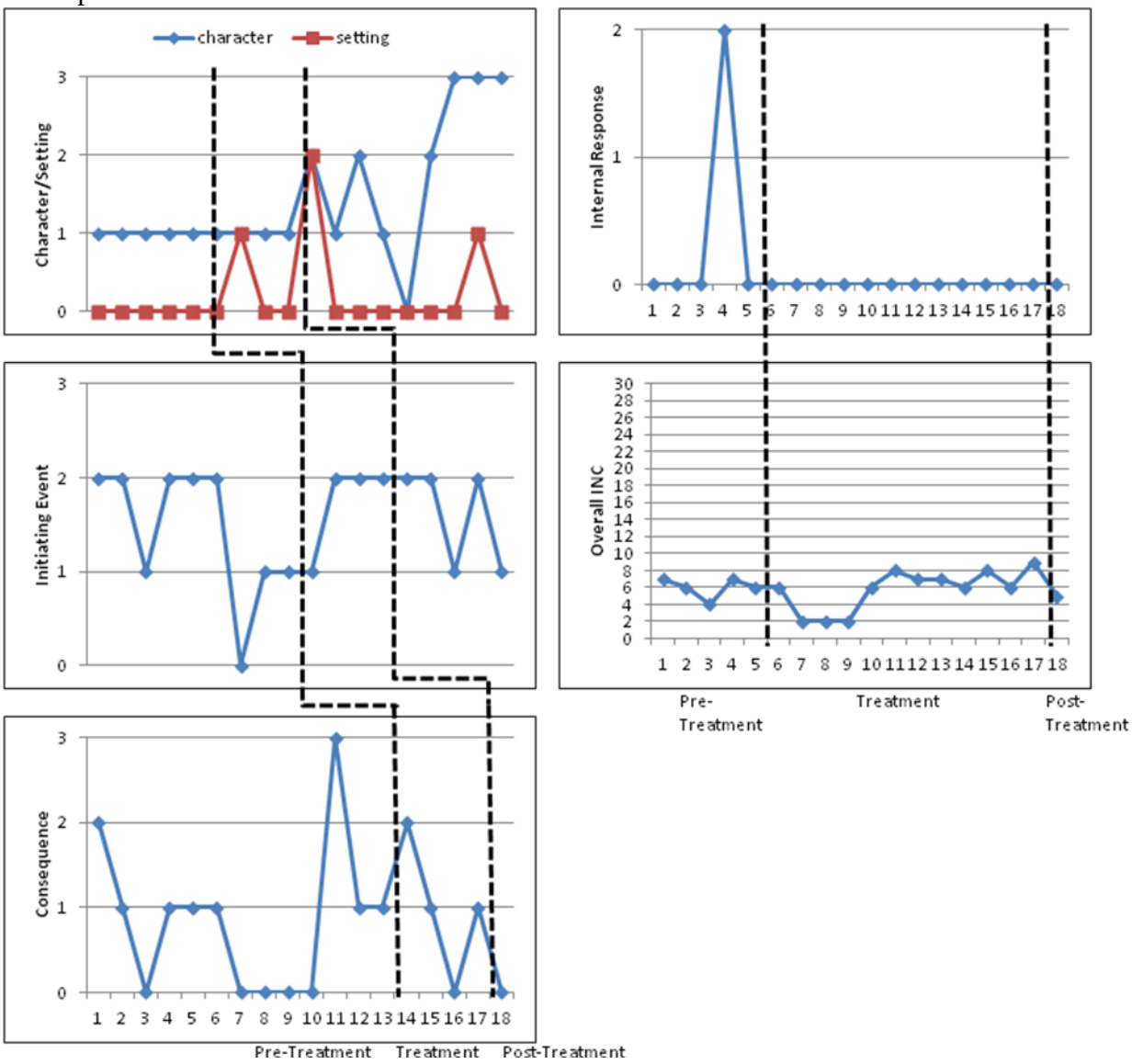


Table 5 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Scene Picture Tasks. The PMDs for the narrative measure Character revealed an increase from the pre-treatment and treatment phases to the post-

treatment phase. The remaining treated and untreated measures as well as overall INC score showed no increase in PMD during Scene Picture Tasks when compared across treatment phases.

Table 5

Participant DS1 Percentage of Maximum Data Points for Scene Picture Tasks

Variable	Pre-Treatment	Treatment	Post-Treatment
Character	0	0	33.3
Setting	0	0	11.1
Initiating Event	0	0	0
Consequence	7.7	0	0
Internal Response	20	0	0
Overall INC Score	0	0	0

The Chi-square analysis for overall INC score was statistically significant (p = .020) all others were nonsignificant (p range = .075 - .858). There was a moderate effect size for the treated narrative measure Character (Φ = .798) and a large effect size for overall INC score (Φ = 1.157) when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ = .271-.406). Follow-up analysis for overall INC score revealed statistically significant differences in treatment and post-treatment comparisons (p = .023) with post-treatment values being greater than treatment values. Pre-treatment and treatment comparisons as well as pre-treatment and post-treatment comparisons did not yield statistically significant results (p range = .112 - .330). There were moderate effect sizes for Overall INC Score during Scene Picture Tasks when comparing pre-treatment and treatment phases (Φ = .582), pre-treatment and post-treatment phases (Φ = 1.000), and treatment and post-treatment phases (Φ = 1.000).

All Tasks Combined. When the narrative measures were collapsed across the three treatment tasks (i.e., story recall, sequenced picture story generation, and scene

picture story generation), the Chi-square analysis for the treated narrative measure Character was statistically significant (p = .008); all others were nonsignificant (p range = .178 - .942). There were moderate effect sizes for the treated narrative measure Character (Φ = .568) and overall INC score (Φ = .719) during Scene Picture Tasks when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ range = .167-.182). Follow-up analysis for Character measure revealed statistically significant differences in pre-treatment and post-treatment comparisons (p = .006) as well as treatment and post-treatment comparisons (p = .008) with treatment values being greater than pre-treatment values and post-treatment values being greater than both pre-treatment and treatment values. There were moderate effect sizes for the treated measure Character during Scene Picture Tasks when comparing pre-treatment and post-treatment phases (Φ = .546) as well as treatment and post-treatment phases (Φ = .551). Remaining comparison of pre-treatment and treatment phases had a small effect size (Φ = .087).

Participant DS2

Story Recall Tasks. Figure 13 displays values for each treated narrative measures (i.e., Character, Setting, Initiating Event, Consequence), the untreated control narrative measure (i.e., Internal Response), and Overall INC Score across pre-treatment, treatment, and post-treatment phases during Story Recall Tasks. None of the treated or untreated measures or the Overall INC Score showed a clear visual trend of improvement when compared across treatment phases.

Figure 13

Participant DS2 Macrostructure Narrative Measures for Story Recall Tasks

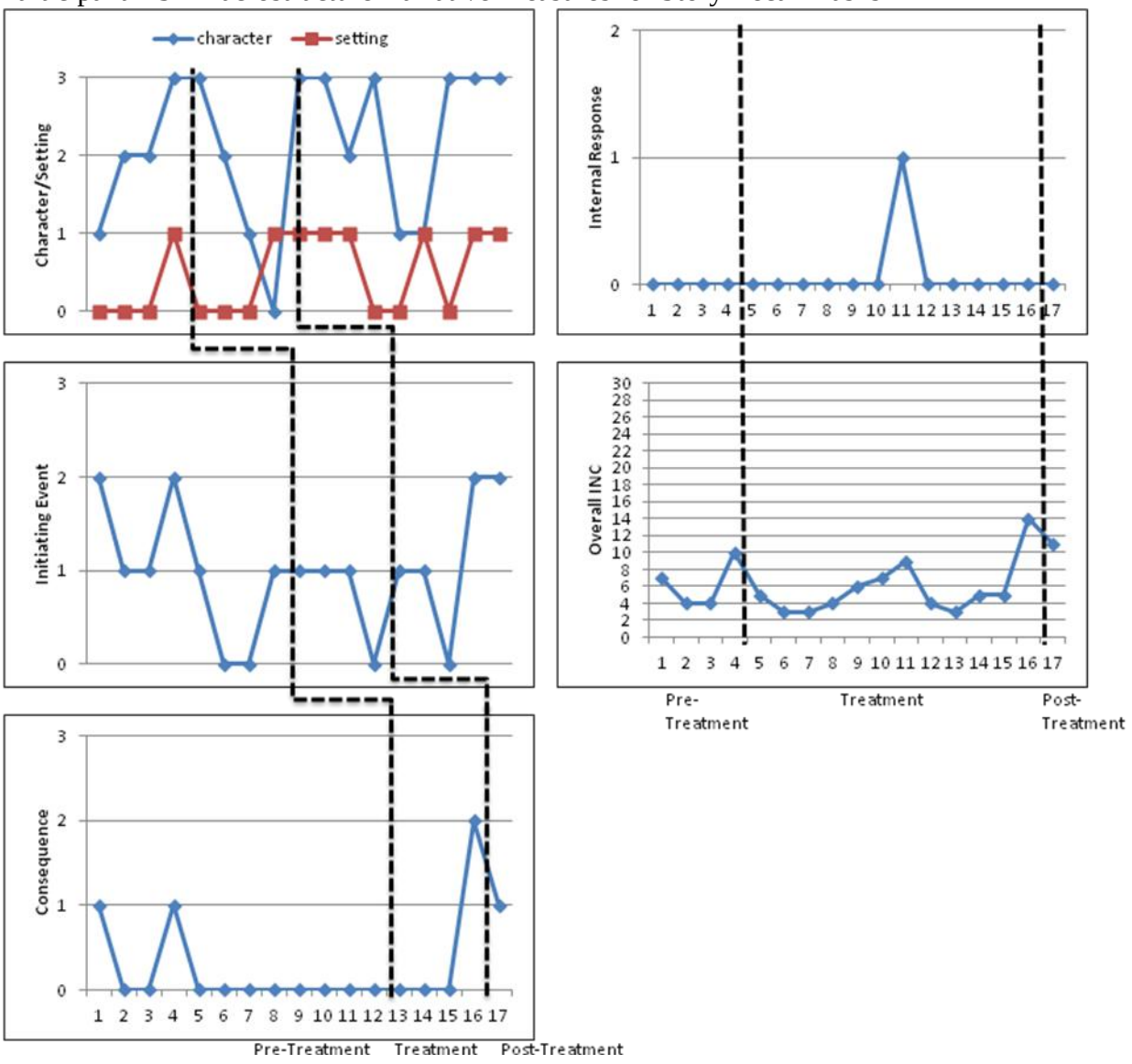


Table 6 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Story Recall Tasks. The PMDs for the narrative measure Character increased across the study phases. The remaining treated and untreated measures as well as the Overall INC Score showed no increase in PMD during Story Recall Tasks when compared across treatment phases.

Table 6

Participant DS2 Percentage of Maximum Data Points for Story Recall Tasks

Variable	Pre-Treatment	Treatment	Post-Treatment
Character	25	25	66.7
Setting	0	0	0
Initiating Event	0	0	0
Consequence	0	0	0
Internal Response	0	0	0
Overall INC Score	0	0	0

Based on the Chi-square analysis, there were no statistically significant differences in treated measures, untreated measures, or Overall INC Score during Story Recall Tasks when compared across treatment phases (*p* range = .061 - .801). However, there were moderate effect sizes for the treated narrative measures of Character (Φ = .624) and Consequence (Φ = .713) and a large effect size for Overall INC Score (Φ = 1.225) when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ range = .161-.417).

Sequenced Picture Tasks. Figure 14 displays values for treated narrative measures, the untreated control narrative measure, and Overall INC Score across pre-treatment, treatment, and post-treatment phases during Sequenced Picture Tasks. The narrative measure Character showed a clear visual trend of increase in the number of maximum data points during the treatment and post-treatment phases when compared to the pre-treatment phase. None of the other treated or untreated measures or the Overall INC Score showed a clear visual trend of improvement during Sequenced Picture Tasks when compared across pre-treatment, treatment, and post-treatment phases.

Figure 14

Participant DS2 Macrostructure Narrative Measures for Sequenced Picture Tasks

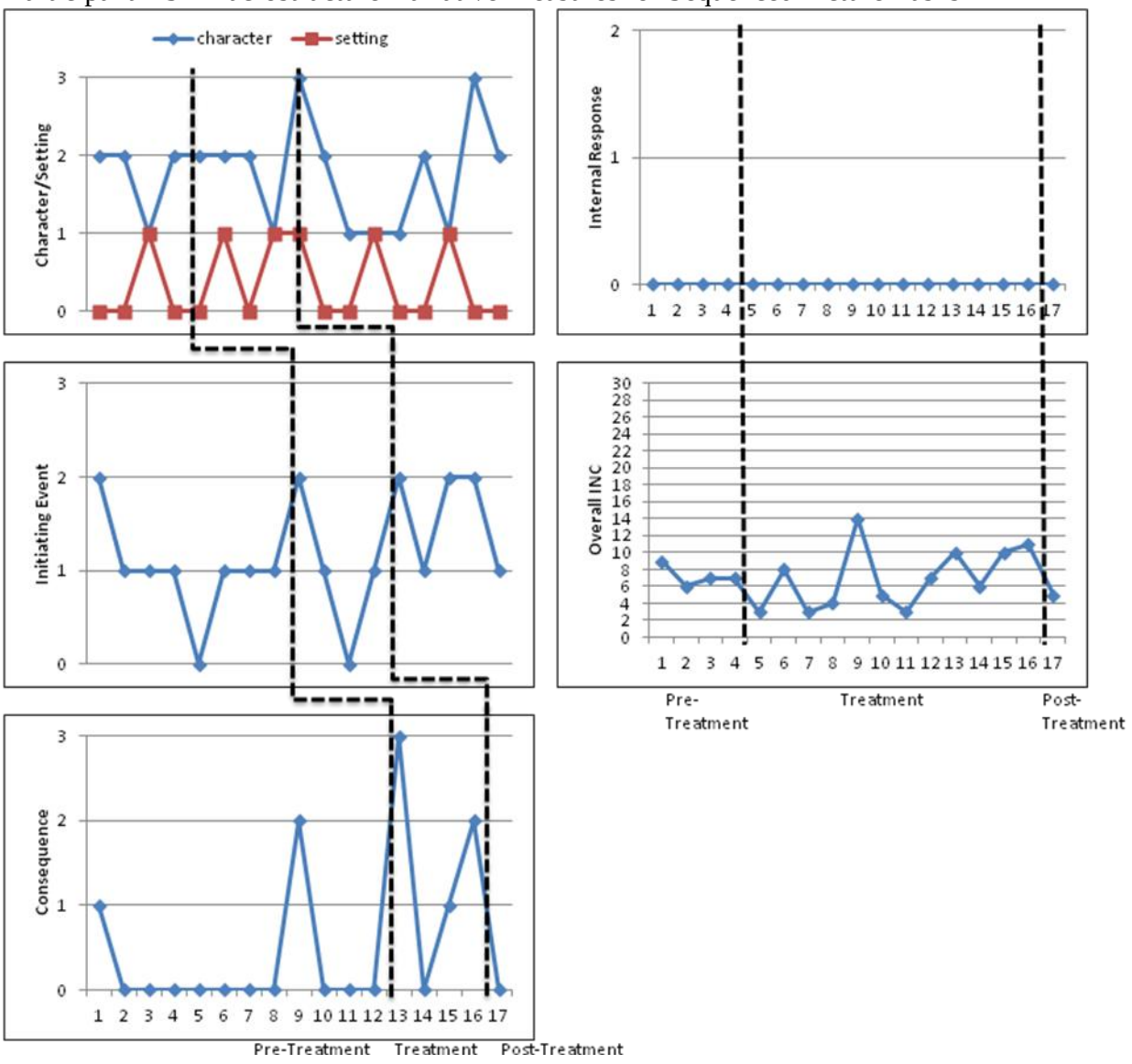


Table 7 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Sequenced Picture Tasks. The PMDs for the narrative measure Character showed an increase across study phases. The remaining treated and untreated measures as well as the Overall INC Score showed no increase in PMD during Sequenced Picture Tasks when compared across treatment phases.

Table 7

Participant DS2 Percentage of Maximum Data Points for Sequenced Picture Tasks

Variable	Pre-Treatment	Treatment	Post-Treatment
Character	0	0	22.2
Setting	0	0	0
Initiating Event	0	0	0
Consequence	0	25	0
Internal Response	0	0	0
Overall INC Score	0	0	0

Based on the Chi-square analysis, there were no statistically significant differences in treated measures, untreated measures, or Overall INC Scores during Sequenced Picture Tasks when compared across treatment phases (*p* range = .368 - .748). However, there were moderate effect sizes for the treated narrative measures Initiating Event (Φ = .502) and Consequence (Φ = .618) and a large effect size for Overall INC Score (Φ = 1.034) when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ range = .000-.461).

Scene Picture Tasks. Figure 15 displays values for treated narrative measures, the untreated control measure, and Overall INC Score across pre-treatment, treatment, and post-treatment phases during Scene Picture Tasks. The narrative measure Character showed a clear visual trend of increase in the number of maximum data points during the post-treatment phase when compared to the pre-treatment and treatment phases. None of the other treated or untreated measures or the Overall INC Score showed a clear visual trend of improvement during Scene Picture Tasks when compared across pre-treatment, treatment, and post-treatment phases.

Figure 15

Participant DS2 Macrostructure Narrative Measures for Scene Picture Tasks

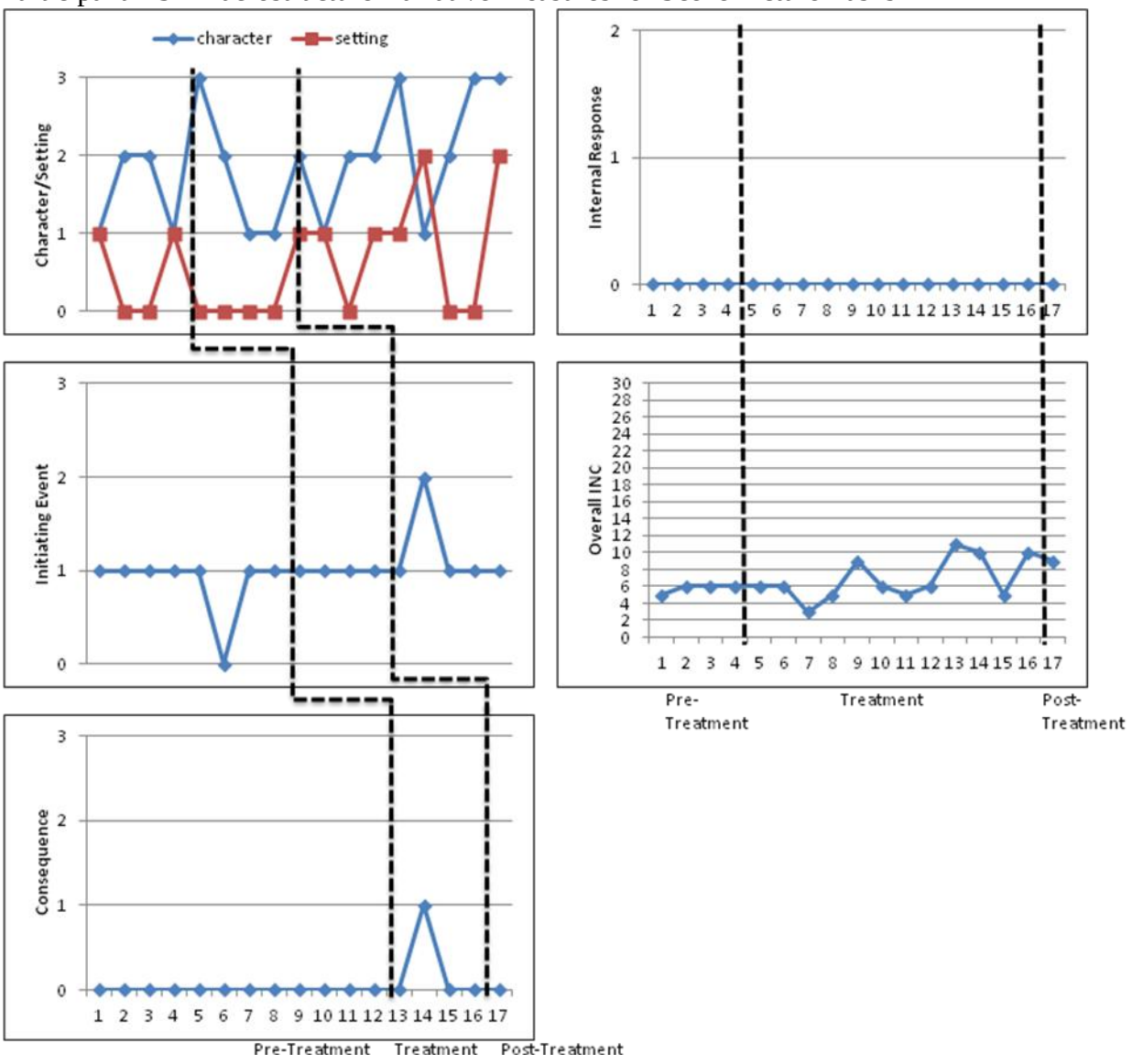


Table 8 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Scene Picture Tasks. The PMDs for the narrative measures Character and Setting showed an increase across study phases. The remaining treated and untreated measures as well as the Overall INC Score showed no increase in PMD during Scene Picture Tasks when compared across treatment phases.

Table 8

Participant DS2 Percentage of Maximum Data Points for Scene Picture Tasks

Variable	Pre-Treatment	Treatment	Post-Treatment
Character	0	25	33.3
Setting	0	0	22.2
Initiating Event	0	0	0
Consequence	0	0	0
Internal Response	0	0	0
Overall INC Score	0	0	0

Based on the Chi-square analysis, there were no statistically significant differences in treated measures, untreated measures, or Overall INC Scores during Scene Picture Tasks when compared across treatment phases (p range = .178 - .628). However, there were moderate effect sizes for the treated narrative measure Setting (Φ = .593) and Overall INC Score (Φ = .798) when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ range = .000-.462).

All Tasks Combined. When the narrative measures were collapsed across the three treatment tasks (i.e., story recall, sequenced picture, and scene picture), the Chi-square analysis revealed no statistically significant differences for treated or untreated measures or Overall INC Scores when compared across pre-treatment, treatment, and post-treatment phases (p range = .157-.809). However, there was a moderate effect size for Overall INC Score (Φ = .619) when compared across treatment phases. All treated and untreated narrative measures had small effect sizes (Φ range = .091-.427).

Participant DS3

Story Recall Tasks. Figure 16 displays values for each treated narrative measures (i.e., Character, Setting, Initiating Event, Consequence), the untreated control narrative measure (i.e., Internal Response), and Overall INC Score across pre-treatment, treatment,

and post-treatment phases during Story Recall Tasks. The narrative measure Character showed a clear visual trend of increase in the number of maximum data points during the treatment and post-treatment phases when compared to the pre-treatment phase. None of the other treated or untreated measures or the Overall INC Score showed a clear visual trend of improvement during Story Recall Tasks when compared across pre-treatment, treatment, and post-treatment phases.

Figure 16

Participant DS3 Macrostructure Narrative Measures for Story Recall Tasks

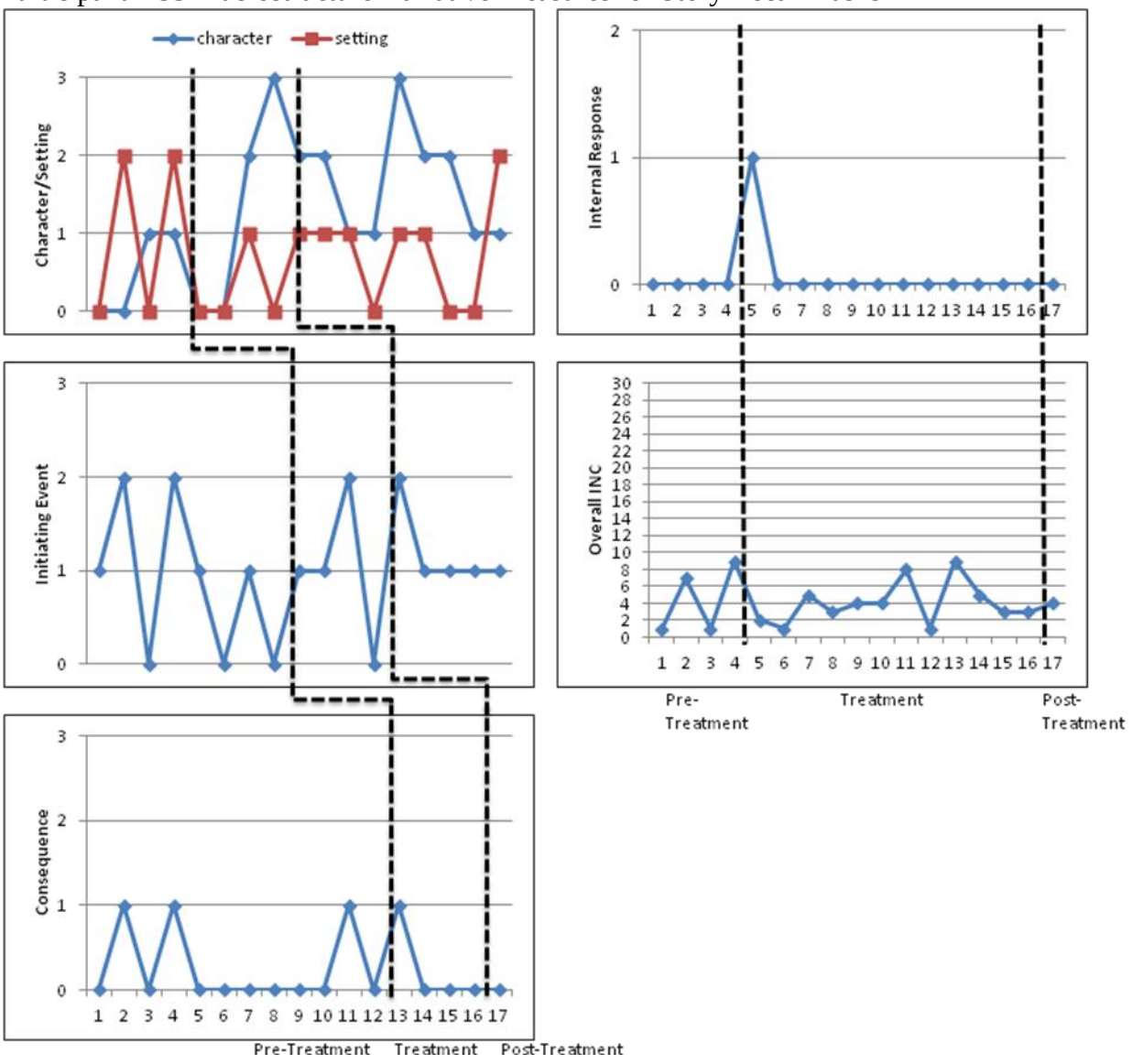


Table 9 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Story Recall Tasks. The treated and untreated measures as well as the Overall INC Score showed no increase in PMD during Story Recall Tasks when compared across phases.

Table 9

Participant DS3 Percentage of Maximum Data Points for Story Recall Tasks

Variable	Pre-Treatment	Treatment	Post-Treatment
Character	0	25	11.1
Setting	50	0	11.1
Initiating Event	0	0	0
Consequence	0	0	0
Internal Response	0	0	0
Overall INC Score	0	0	0

Based on the Chi-square analysis, there were no statistically significant differences in treated measures, untreated measures, or Overall INC Scores during Story Recall Tasks when compared across treatment phases (p range = .141 - .849). However, there were moderate effect sizes for the treated narrative measures Character (Φ = .741) and Setting (Φ = .637) and a large effect size for Overall INC Score (Φ = .882) when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ range = .139-.416).

Sequenced Pictures Tasks. Figure 17 displays values for treated narrative measures, the untreated control measure, and Overall INC Score across pre-treatment, treatment, and post-treatment phases during Sequenced Picture Tasks. None of the treated or untreated measures or the Overall INC Score showed a clear visual trend of improvement during Sequenced Picture Tasks when compared across treatment phases.

Figure 17

Participant DS3 Macrostructure Narrative Measures for Sequenced Picture Tasks

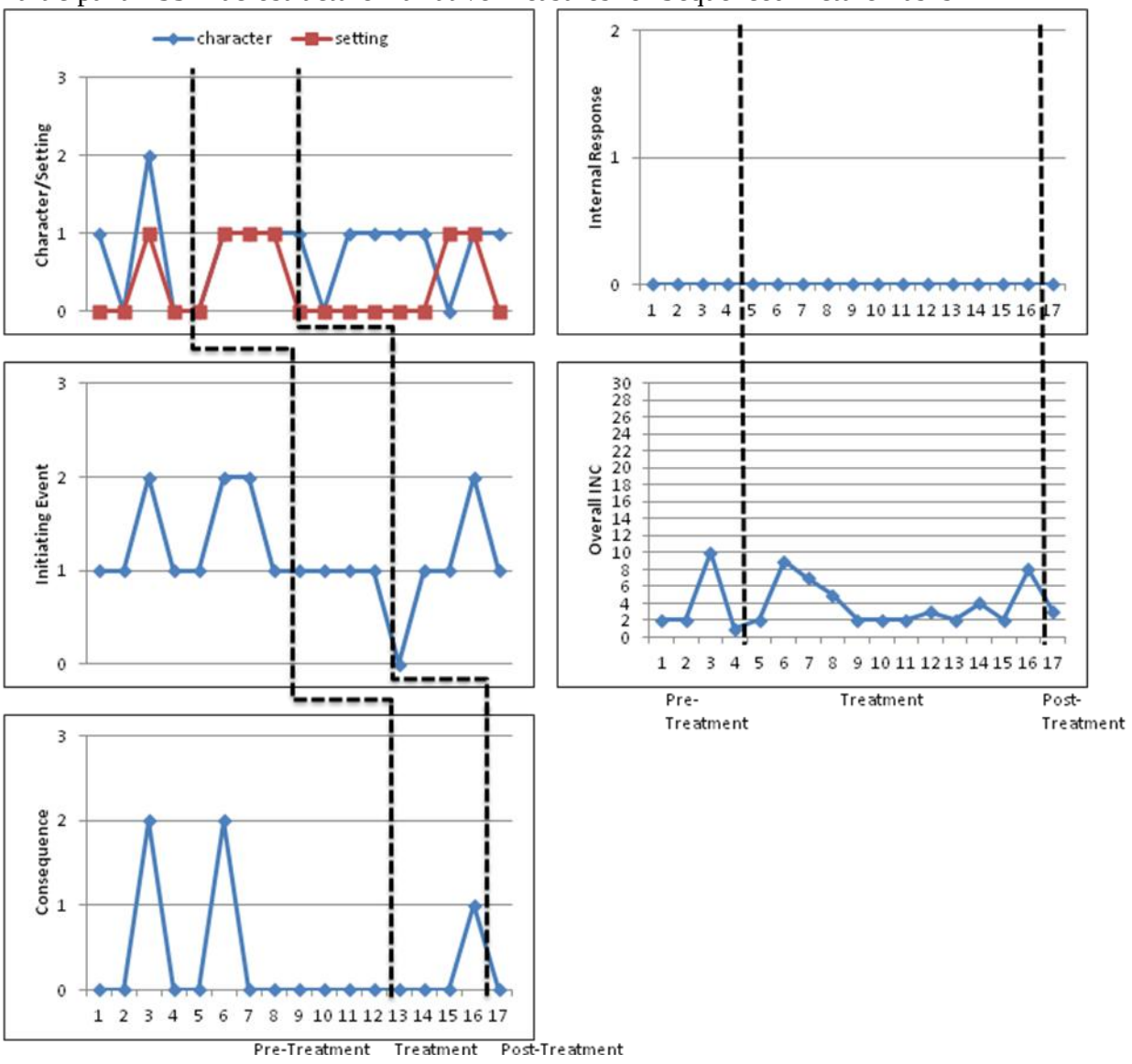


Table 10 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Sequenced Picture Tasks. The treated and untreated measures as well as the Overall INC Score showed no increase in PMD during Sequenced Picture Tasks when compared across treatment phases.

Table 10

Participant DS3 Percentage of Maximum Data Points for Sequenced Picture Tasks

Variable	Pre-Treatment	Treatment	Post-Treatment
Character	0	0	0
Setting	0	0	0
Initiating Event	0	0	0
Consequence	0	0	0
Internal Response	0	0	0
Overall INC Score	0	0	0

Based on the Chi-square analysis, there were no statistically significant differences in treated measures, untreated measures, or Overall INC Scores during Sequenced Picture Tasks when compared across treatment phases (p range = .164 - .433). There were moderate effect sizes for the treated narrative measures Character (Φ = .558) and Initiating Event (Φ = .524) and a large effect size for Overall INC Score (Φ = .979) when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ range = .000-.494).

Scene Picture Tasks. Figure 18 displays values for treated narrative measures, the untreated control measure, and Overall INC Score across pre-treatment, treatment, and post-treatment phases during Scene Picture Tasks. The narrative measures Character, Initiating Event, and Consequence showed a clear visual trend of increase in the number of maximum data points during the treatment and post-treatment phases when compared to the pre-treatment phase. The Overall INC Score showed a general trend of improvement across study phases. None of the other treated or untreated measures or the Overall INC Score showed a clear visual trend of improvement during Story Recall Tasks when compared across pre-treatment, treatment, and post-treatment phases.

Figure 18

Participant DS3 Macrostructure Narrative Measures for Scene Picture Tasks

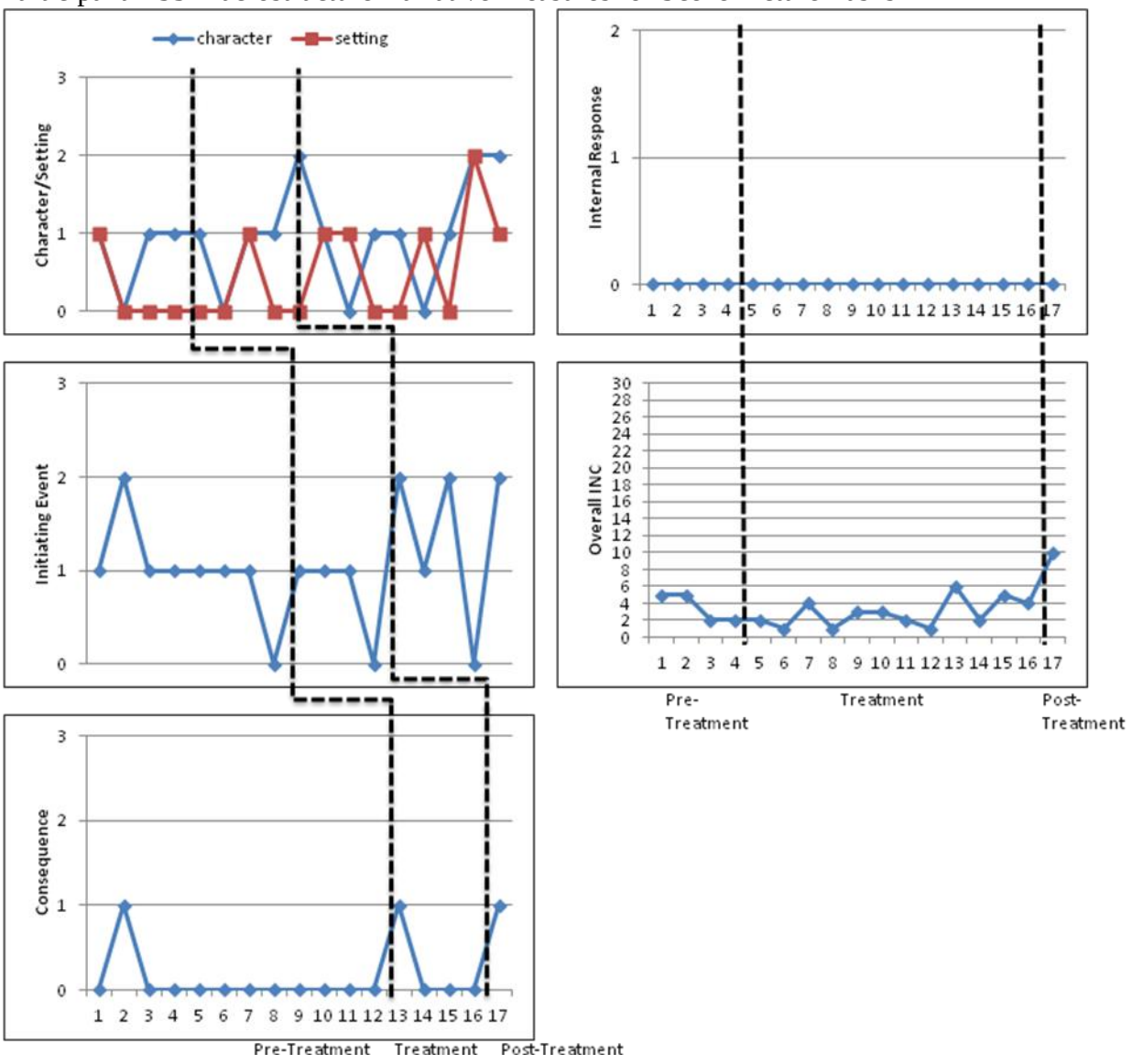


Table 11 includes the PMD data for the pre-treatment, treatment, and post-treatment phases during Scene Picture Tasks. The PMDs for the narrative measure Setting showed an increased across study phases. The remaining treated and untreated measures as well as the Overall INC Score showed no increase in PMD during Scene Picture Tasks when compared across treatment phases.

Table 11

Participant DS3 Percentage of Maximum Data Points for Scene Picture Tasks

Variable	Pre-Treatment	Treatment	Post-Treatment
Character	0	0	0
Setting	0	0	11.1
Initiating Event	0	0	0
Consequence	0	0	0
Internal Response	0	0	0
Overall INC Score	0	0	0

The Chi-square analysis for overall INC score was statistically significant (p = .024); all others were nonsignificant (p range = .063 - .733). There were moderate effect sizes for the treated narrative measures Initiating Event (Φ =.607) and Consequence (Φ =.570) and a large effect size for Overall INC Score (Φ =1.174) when compared across treatment phases. Remaining treated and untreated narrative measures had small effect sizes (Φ range=.000-.444). Follow-up analysis for Overall INC Score revealed statistically significant differences in treatment and post-treatment comparisons (p = .043) with post-treatment values being greater than treatment values. Pre-treatment and treatment comparisons as well as pre-treatment and post-treatment comparisons did not yield statistically significant results (p range = .082 - .302). There were moderate-to-large effect sizes for Overall INC Score during Scene Picture Tasks when comparing pre-treatment and treatment phases (Φ = .615), pre-treatment and post-treatment phases (Φ = 1.000), and treatment and post-treatment phases (Φ = 1.000).

All Tasks Combined. When the narrative measures were collapsed across the three treatment tasks (i.e., story recall, sequenced picture, and scene picture), the Chi-square analysis revealed no statistically significant differences for treated or untreated measures or Overall INC Scores when compared across pre-treatment, treatment, and

post-treatment phases (*p* range = .376-.809). However, Overall INC Score showed a moderate effect size (Φ =.615) when compared across treatment phases. All treated and untreated narrative measures had small effect sizes (Φ range=.091-.346).

Discussion

In the current study, the computer-based narrative language intervention positively impacted some microstructure and macrostructure narrative elements in each of the three adolescent participants with Down syndrome. Positive gains were observed on some of the microstructure narrative elements as well as some of the treated macrostructure narrative elements; however, the strength of the impact varied across tasks and participants. Based on visual inspection of data points, percentage of maximum data points, and chi-square analysis, the most significant gains were found on the microstructure narrative element Number of Utterances and the macrostructure narrative element Character. Minimal gains were found on the other microstructure measures (i.e., Mean Length of Utterance as well as Bound Morphemes) as well as the other macrostructure narrative measures (i.e., Setting, Initiating Event, Consequence, and Overall INC Score). Treated macrostructure narrative measures yielded medium-to-large effect sizes and untreated macrostructure narrative measures yielded small effect sizes across all tasks and all participants.

Participant DS1 demonstrated an increase in the Number of Utterances and Bound Morphemes when comparing initial baseline sessions and final treatment sessions. Participant DS1 also demonstrated significant improvement that resulted in moderate effect sizes on the macrostructure narrative measure Character. Additionally, moderate-

to-large effect sizes were found for the Overall INC Score across all treatment tasks. Other significant findings include an increase in percentage of maximum data points for the treated narrative measures Initiating Event and Consequence as well as moderate effect sizes for the treated narrative measures Setting and Consequence during Sequenced Picture Tasks.

Participant DS2 demonstrated no improvement in microstructure narrative elements; however, Participant DS2 demonstrated moderate improvement on the Character macrostructure measure. Although Chi-square analysis did not reveal statistically significant differences across treatment phases, there were moderate effect sizes for the narrative measure Character. Additionally, there were moderate effect sizes for Setting, Initiating Event, and Consequence as well as a large effect size for Overall INC Score during Sequenced and/or Scene Picture Tasks.

Participant DS3 demonstrated an increase in the microstructure narrative element Number of Utterances when comparing initial baseline sessions and final treatment sessions. However, these increases should be interpreted cautiously as Participant DS3 demonstrated improvement on microstructure narrative elements during baseline sessions. Improvements during baseline sessions indicate that improvements observed during and following treatment may have been due to something other than treatment. Participant DS3 also demonstrated moderate improvement on the Character macrostructure measure. The Setting, Initiating Event, and Consequence macrostructure measures showed a slight increase in percentage of maximum data points as well as moderate effect sizes across treatment tasks. Chi square analysis revealed statistically

significant differences as well as large effect sizes for Overall INC Score across treatment tasks.

Overall, positive treatment effects were observed on some microstructure and macrostructure measures; however, these effects were limited and varied across tasks and participants. Taking all analyses into account, Participant DS1 made the greatest gains and the Scene Picture Task elicited the strongest participant performance. Limited treatment effects may have been due to the number of treatment sessions, the intervention approach, the selected target narrative goals, measure sensitivity, or participant characteristics.

Number of Treatment Sessions. Previous research has demonstrated the efficacy of traditional narrative language interventions to improve the microstructure and macrostructure narrative skills of children with primary language impairment (Swanson, et al., 2005). The current study attempted to evaluate the extension of such interventions for adolescents with Down syndrome incorporating an animated computer program. The current study comprised 4 baseline sessions, 12 intervention sessions, and a single follow-up session spanning approximately 9 weeks. Results from the current study revealed that there were an insufficient number of sessions. In future investigations, the number of baseline, treatment, and follow-up sessions should be extended. Baseline sessions should be increased to ensure stability of targeted measures prior to initiation of treatment. Target measures should be scored and tracked during baseline sessions and treatment should only be initiated once target measures are considered stable during baseline sessions. Additionally, treatment sessions should be increased to give

participants a greater number of opportunities to make gains. In the current study, participants had very few sessions targeting each goal. Future studies should consider targeting fewer goals for longer periods of time or, if the same number of goals are targeted, increasing the overall number of sessions. Ideally, each goal should be targeted until improvement is noted across multiple sessions. Additional follow-up sessions should be conducted to measure the stability of gains across a longer period of time following the cessation of intervention.

Intervention Approach. Team up with Timo (Timo; Animated Speech Corporation, 2010) computer software was used to facilitate the narrative treatment goals. The program offered a platform to incorporate explicit instruction regarding the narrative macrostructure goals. Despite this advantage, the animation and story topics were geared towards young children, not adolescents with developmental delays. Stories contained within Timo presented daily activities not necessarily relevant for adolescents such as jumping in puddles. This lack of relevancy may negatively impact generalization. Future investigations should incorporate a more age-appropriate technology, such as an iPad, iPod, or iTouch, as a platform to facilitate narrative language intervention as well as promote buy-in and generalization. Stories should encompass age-appropriate topics such as school, homework, afterschool activities, part-time employment, or family issues.

Target Narrative Goals. The same narrative macrostructure goals were targeted for each of the three participants. These specific goals were selected based on the potential quality impact they would have on narrative production. However, there was considerable variability in initial skills for each of the target measures. For example,

during baseline sessions, Participant DS1 earned a maximum score (i.e., 3) on the narrative measure Character during two tasks. This is also the measure that yielded the most gains. In another instance, Participant DS2 earned the minimum score (i.e., 0) on the narrative measure Consequence in almost all baseline and treatment sessions during scene picture tasks. Thus, this goal may have been outside the zone of proximal development for Participant DS2. This participant may have demonstrated more success if treatment had targeted a goal that was beginning to show some increases in performance and could be considered within the zone of proximal development (as was the case for Participant DS1 Character goal). Future investigations should target individualized goals that are more within the zone of proximal development in order to maximize treatment effects.

The current study did not explicitly target microstructure forms as part of the treatment. Study results indicated some gains at the microstructure level. In previous studies that have directly targeted grammatical forms (Swanson, et al., 2005) positive gains on these measures have been documented. Given the trend of gains in these areas, participants are likely to demonstrate greater gains at the microstructure level with direct instruction. Thus, future investigations should include explicitly target microstructure goals during intervention.

Measure Sensitivity. The Index of Narrative Complexity (INC; Petersen, et al., 2008) is a tool used for evaluating macrostructure narrative elements. The INC addresses 13 aspects of story grammar based on quantity and/or quality of response. Depending on the narrative category, coders assigned scores ranging from 0-2 or 0-3. Due to the small

scale of scores for each individual category, it is difficult to track small but clinically significant changes in each category during and following intervention. For example, during Sequenced Picture Tasks, Participant DS1 earned a maximum score (i.e., 3) for the narrative measure Character in one opportunity during baseline sessions and in two opportunities during follow-up sessions. In another case, during scene picture tasks, Participant DS2 earned a minimum score (i.e., 0) for the narrative measure Consequence in all opportunities during baseline sessions and in 4 out of 5 opportunities during treatment and follow-up sessions. These participants may have in fact improved the quality of story character descriptions in ways which were not captured by the INC coding system. The participant at the high end (DS1) may have made gains beyond the rubric, while the participant at the low end (DS2) may have made gains that were not large enough to warrant the coder to assign a higher score. Future studies should consider measures with greater scoring ranges, such as the Narrative Structure Scoring (NSS; Heilmann, Miller, & Nockerts, 2010) which has a 0 to 5 rating scale. More sensitive measures are likely to be better suited to detect small changes across treatment tasks and may be more appropriate for evaluating intervention outcomes.

Participant Characteristics. The narrative language intervention evaluated in this study improved the ability of adolescents with Down syndrome to relate past, present, or future events. It is, however, important to consider that this intervention is not appropriate for all individuals with Down syndrome including those with severe deficits in speech production as well as those with severe cognitive deficits.

Children and adolescents with Down syndrome and other developmental disabilities frequently demonstrate multiple treatment needs in the area of expressive language including morphology, syntax, narrative skills, discourse, and speech production. The high frequency of significantly reduced speech intelligibility in children and adolescents with Down syndrome creates challenges when targeting other areas of expressive language during intervention. A hierarchy of treatment goals must be implemented to ensure effects of intervention. Thus, to target and reliably evaluate narrative language and discourse skills, participants with significantly reduced speech intelligibility must first receive intervention targeting speech intelligibility at the sentence level. Once a level of moderate intelligibility has been achieved, a narrative intervention may be appropriately implemented. Alternatively, a treatment approach that simultaneously targets both speech intelligibility and narrative language may be used; however, further investigation of such an approach is necessary.

Future Directions

Continued research is required to determine the effectiveness of language interventions designed to improve the microstructure and macrostructure narrative skills of individuals with Down syndrome. Future research should address the limitations previously discussed as well as focus on more functional contexts such as personal narratives. Due to the relative strengths of social-emotional development of individuals with Down syndrome, future research should address narrative skills as they relate to retelling personal stories. For example, participants may be asked to share a story regarding a recent event in their life.

In the current investigation, explicit teaching of macrostructure narrative elements facilitated by an animated computer program had a positive, albeit modest, impact on the microstructure and macrostructure narrative language abilities of adolescents with Down syndrome. Gains were limited such that improvements were not found across all measures, contexts, or participants. Continued research is required to further evaluate the effects of such narrative language treatment on the microstructure and macrostructure narrative abilities of adolescents with Down syndrome in order to better understand for whom such interventions are most appropriate and how such interventions should be implemented to achieve maximal outcomes.

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Appendices

Appendix A

Form for Analyzing Fidelity of Treatment

FIDELITY OF TREATMENT Evaluation of Narrative Language Intervention for Adolescents with Down Syndrome							
Intervention Procedures	**Session**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Discuss Goal: Label, describe, specificity desired, example							
Listen to Story: Label, describe, specificity desired, example							
Comprehension Questions: Provide up to one repeat per question; Label, describe, specificity desired, example							
Story Scramble/Retell: Label, describe, specificity desired, example							
Game #1:Provide up to one repeat per question, mention goal once							
Game #2: Provide up to one repeat per question, mention goal once							
Game #3: Provide up to one repeat per question, mention goal once							
Game #4 : Provide up to one repeat per question, mention goal once							
Game #5: Provide up to one repeat per question, mention goal once							
Game #6: Provide up to one repeat per question, mention goal once							
Total -/10							
Percentage							
Goal One: Character and Setting – A character is a person or an animal in a story. A story might have more than one character. It is important to be specific when talking about a character and call each character by a name. The story we are going to read today has a character named [INSERT CHARACTER]. A setting is the time and place in a story. It is important to be specific when talking about a setting. The story we are going to read today happens at [INSERT SETTING].							
Goal Two: Initiating Event/Problem - A problem in a story is something that happens to make a character do or feel something. For example [INSERT PROBLEM] is a problem because it is something that happened to make [INSERT CHARACTER PLUS ACTION OR FEELING].							
Goal Three: Consequence - The consequence is something that happens in a story because of something a character does. For example [INSERT CONSEQUENCE] is a consequence because it is something that happened because [INSERT CHARACTER PLUS ACTION].							

Appendix B

Scoring Guidelines for the Index of Narrative Complexity (INC)

CHARACTER			
CHARACTER: A character is any reference to the subject of a clause. Only code each character one time.			
3 Points	**2 Points**	**1 Point**	**0 Points**
More than one main character with a specific name *Examples* *(a) Once there was a boy named Charles and a girl named Mary.*	**One main character with a specific name** *Examples* *(a) Once there was a boy named Charles.*	**At least one main character with a non-specific label** *Examples* *(a) The boy was walking.*	**No main character, only ambiguous pronouns** *Examples* *(a) He was walking.*
SETTING			
SETTING: A setting is any reference to a place or time. Only code each setting one time.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable	**At least one reference to a specific place or time** *Examples* *(a) Once there was a boy walking in central park.* *(b)They were walking at 10:00 at night.*	**At least one reference to a general place or time** *Examples* *(a) The boy and the girl were outside.* *(b) It was daytime.* *(c) One day, they went to the park.*	**No reference to a specific or general place or time** *Examples* *(a) The boy and the girl were walking.*

INITIATING EVENT			
INITIATING EVENT: An initiating event is any reference to an event or problem that elicits a response from the character(s).			
3 Points	**2 Points**	**1 Point**	**0 Points**
Two or more events or problems that elicit a response from the character(s) *Examples* *(a) The girl was walking in a park and saw a spaceship land and some aliens (IE1). The girl started to run away (Action). But while she was running, her shoe got stuck in a hole (IE2). She knelt down and took off her shoe to get unstuck (Action).*	**One event or problem that elicits a response from the character(s)** *Examples* *(a) The girl was walking in a park and saw a spaceship land and she saw some aliens (IE). The girl started to run away (Action).*	**At least one event or problem likely to elicit a response from a character without a response directly related to that event** *Examples* *(a) The girl was walking in a park and saw a spaceship land (IE) and she saw some aliens and a dog and a table.*	**No event or problem likely to elicit a response from a character** *Examples* *(a) The boy and girl were walking in the park.*
INTERNAL RESPONSE			
INTERNAL RESPONSE: An internal response is any reference to information about the psychological state of a character including emotions, desires, feelings, or thoughts.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable.	**One or more overt statements about character psychological state causally related to an event or problem** *Examples* *(a) The aliens' landed. Sara saw the ship and was terrified.*	**One overt statement about character psychological state not causally related to an event or problem** *Examples* *(a) The dog was sad, the girl was happy.*	**No overt statement about character psychological state**

PLAN			
PLAN: A plan is any cognitive verb reference that is intended to act on or solving an initiating event. It must include a "cognitive verb" that indicates a plan. The plan and the action/attempt can share the same clause (see 2 Points example b).			
3 Points	**2 Points**	**1 Point**	**0 Points**
Three or more overt statements about how the character might act on or solve the event(s) or problem(s)	**Two overt statements about how the character might act on or solve the event(s) or problem(s)** *Examples* *(a) The girl was very excited and she told the boy that she wanted to go meet the aliens.* *(b) The boy was very scared so he decided to sneak away quietly.*	**One overt statement about how the character might act on or solve the event(s) or problem(s)** *Examples* *(a) The girl thought that it would be neat to go and meet the aliens.*	**No overt statement about how a character might act on or solve the event(s) or problem(s)** *Examples* *(a) The girl was very excited and she ran out to meet the aliens.*
ACTION			
ACTIONS: Actions are taken by the main character(s) but are not directly related to the initiating event. Attempts are taken by the main character(s) and are directly related to the initiating event.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable	**Attempts by main character are directly related to the IE** *Examples* *(a)The girl thought that it would be neat to go and meet the aliens so she got away from the boy and walked out on the grass.*	**Actions by main character are not directly related to the IE** *Examples* *(a) The boy and the girl were walking in a park.* *(b) They saw a boy alien waving.*	**No actions are taken by the main character(s)** *Examples* *(a) There is a girl. There is a boy. It is sunny.*

COMPLICATION			
COMPLICATION: A complication is an event that prohibits the execution of a plan or action taken in response to an initiating event. A complication can also be a second initiating event. In this case, code both a complication and initiating event.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable	**Two distinct complications that prohibit plans or actions from being accomplished** *Examples* *(a) The girl was walking in a park and saw a spaceship land and some aliens (IE1). The girl started to run away (Action1). But while she was running, her shoe got stuck in a hole (Complication1 / IE2). She knelt down and took off her shoe to get unstuck (Action2) but she was shaking too much to get her shoe off (Complication2).*	**One complication that prohibits a plan or action from being accomplished** *Examples* *(a) The spaceship landed. The girl decided to get away from the aliens and started running from the spaceship. While she was running, her shoe got stuck in a hole. She could not get away from the aliens.*	**No complications that prohibit a plan or action from being accomplished**

CONSEQUENCE			
CONSEQUENCE: A consequence resolves the problem or does not resolve the problem. It must be related to the initiating event and explicitly stated. A consequence for one episode can often be the initiating event for another.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Three or more consequences	**Two consequences** *Examples* *(a) They told their parents the spaceship was in the park. But their parents didn't believe them. When they took their parents to the park the spaceship was gone.* *(b) The boy wanted a frog. He went to the woods to find one. He couldn't find a frog.*	**One consequence** *Examples* *(a) The spaceship landed. The aliens were happy to see her and cried when they flew away.*	**No consequence** *Examples* *(a) She got away from the boy and walked out onto the grass. The alien girl had a dress on.*

FORMULAIC MARKERS			
FORMULAIC MARKERS: A formulaic marker is any standard utterance used to mark the beginning or ending of a narrative (e.g., the end, once, once upon a time, they lived happily ever after, etc.). Only count each marker once.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable	**Two or more formulaic utterances**	**One formulaic utterance**	**No formulaic utterances**

TEMPORAL MARKERS			
TEMPORAL MARKERS: Temporal markers are used to indicate time (e.g., when, next, then, immediately, instantly, after, again, already, always, before, lately, now, once, presently, rarely, today, weekly, while). Only count each marker once.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable	**Two or more temporal markers**	**One temporal marker**	**No temporal markers**

CAUSAL ADVERBIAL CLAUSES			
CAUSAL ADVERBIAL CLAUSES: Causal adverbs are use to indicate cause (e.g., because, since, so that, therefore, as a result, consequently, thus, hence, etc.). Causal adverbs do not have to occur in concurrent sentences. Only count each clause once.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable	**Two or more causal adverbial clauses**	**One causal adverbial clause**	**No causal adverbial clauses**
KNOWLEDGE OF DIALOGUE			
KNOWLEDGE OF DIALOGUE: Knowledge of dialogue is registered by a comment or statement made by a character or by characters engaging in conversation.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable	**Two or more characters engage in conversation** *Examples (a) He said "Oh look, there is an alien" and she said "Oh, let's go see it."*	**One character makes a comment or statement** *Examples (a) He said "Ow!" (b) He said "Don't come over here/"*	**No dialogue**
NARRATOR EVALUATIONS			
NARRATOR EVALUATIONS: Narrator evaluations are any explanation provided in the story to justify why an action or event took place. (e.g., because, since, so, in order to). Each evaluation is given a point, regardless of the word used to make the evaluation. In other words, the same word (i.e., because) may be used to make multiple evaluations.			
3 Points	**2 Points**	**1 Point**	**0 Points**
Not applicable	**Two or more narrator evaluations** *Examples (a) She knew it was an alien spaceship because everyone knows about UFOs. (b) He wanted to run from the aliens since they were his worst nightmare.*	**One narrator evaluation** *Examples (a) She ran up to say hello to the alien because she always wanted to meet one.*	**No narrator evaluations**