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Research Note

Exploring Summarization Differences for Two Types of Expository Discourse in Adolescents With Traumatic Brain Injury

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Purpose: Annually, nearly 700,000 U.S. children and adolescents experience a traumatic brain injury (TBI). Many of them struggle academically, despite failing to qualify for special education services because their cognitive communication impairments are subtle.
Method: In this exploratory study, five adolescents with TBI provided verbal summaries of two expository lectures (compare–contrast, cause–effect) and participated in cognitive and expressive syntax testing. Their performance on these tasks was compared descriptively to that of 50 adolescents with typical development.
Results: For adolescents with TBI, mean summary quality scores for both exposition types were at least 1 *SD* lower than those of adolescents with typical development and notably 2 *SD*s below for the cause–effect passage. The adolescents with TBI who had below-average cognitive scores showed better performance on compare–contrast summaries compared to cause–effect, whereas the majority of adolescents with typical development showed the opposite tendency.
Conclusions: These results provide preliminary evidence that students with TBI, particularly those with cognitive deficits, may struggle with expository discourse despite acceptable performance on a measure of expressive syntax. This study also indicates that researchers should explore how students with TBI perform on academically relevant discourse tasks in order to inform future assessment and intervention efforts.
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Every year in the United States, nearly 700,000 children under the age of 19 years experience a traumatic brain injury (TBI; Faul, Xu, Wald, & Coronado, 2010), resulting in an estimated 2.5 million students with TBI in the U.S. educational system (Dettmer, Daunhauer, Detmar-Hanna, & Sample, 2007). After acute hospitalization, even for many students with severe injuries, TBI often becomes “invisible” with no physical manifestations of the injury apparent to caregivers and school personnel (Laatsch et al., 2007). Yet, there are often subtle, persistent changes in social, behavioral, cognitive, and physical functioning that can affect the family, social, and academic lives of these individuals (Catroppa, Anderson, Morse, Haritou, & Rosenfeld, 2008; Schwartz et al., 2003; Yeates et al., 2004, 2005). For many children with TBI, use of typical, standardized child language and neuropsychological assessments may fail to identify the subtle cognitive communication deficits associated with such injuries (Coelho, 2007; Cook, DePompei, & Chapman, 2011; Ylvisaker et al., 2005). Students may then fail to qualify for special education services, contributing further to the significant discrepancy between those who report to hospitals with TBI and those who are identified by school systems and receive support services under that designation (Schutz, Rivers, McNamara, Schutz, & Lobato, 2010). Without support, the likelihood of academic and social success is diminished (Gillam, Peña, & Miller, 1999; Walz, Yeates, Taylor, Stancin, & Wade, 2012). Thus, educators and clinicians must identify more effective ways to assess students with TBI and provide needed services across the educational continuum.

One potential method to improve identification might be to include assessments of expository discourse production and/or comprehension. Expository discourse, which has been called the “language of the curriculum” (Ward-Lonergan, 2010), involves the transfer of information to a listener or

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reader. It is critical for students to be able to demonstrate competence in the two distinct processes of comprehension and production of expository discourse to promote academic success (Gillam, Hoffman, Marler, & Wynn-Dancy, 2002). Even for adults and children with typical development (TD), the cognitive complexity involved in comprehending and producing expository discourse frequently makes it more challenging than conversational and narrative discourse (Nippold & Scott, 2010; Snyder & Caccamise, 2010). For individuals with TBI, discourse difficulties may persist many years after the injury and negatively impact quality of life (Chapman et al., 2006; Coelho, 2007; Scott, 2010) and academic achievement (Gillam et al., 1999; Walz et al., 2012), including the critical skills of reading and writing (Griffin, Hemphill, Camp, & Wolf, 2004). Yet only two studies (Chapman et al., 2006; Hay & Moran, 2005) have examined the performance of children and adolescents with TBI on expository tasks.

Because existing standardized language assessments often fail to identify deficits in students with a TBI, assessment of expository abilities may better elucidate the persistent yet subtle cognitive communication challenges typically experienced by these students. Discourse difficulties may result from the common cognitive impairments experienced after TBI, such as deficits in attention, working memory, and executive functions (Moran & Gillon, 2010; Walz et al., 2012), key skills linked specifically to comprehension of expository discourse (Wolfe & Mienko, 2007; Wolfe & Woodwyk, 2010). In order to comprehend an expository passage for later recall, a student must integrate new facts with previously learned information through working memory and attentional processes. Several studies have identified that these cognitive processes may be more critical for comprehension and recall of expository discourse than for other discourse genres. For example, Wolfe and colleagues (Wolfe & Mienko, 2007; Wolfe & Woodwyk, 2010) showed that recall of facts from expository texts, but not narratives, is linked to a participant's prior knowledge. Expository discourse, in particular, seems to require the integration of new information with previously learned facts through a reliance on higher-level cognitive skills. As a practical example, a student sitting in science class learning about the water cycle must be able to integrate today's lesson about precipitation with yesterday's lesson about evaporation and condensation. Students who struggle with attention, working memory, and executive functions and are unable to incorporate facts from today's class with prior knowledge from a past lecture may be very confused about how water from the local river ends up raining down from the sky. Because expository discourse relies heavily on the cognitive skills typically disrupted following TBI and because of its relevance to the academic setting, exposition may provide a more appropriate context in which to evaluate an individual's ability to apply cognitive skills such as those mentioned above. Assessments utilizing expository discourse may be a helpful method for identifying students whose return to school is marked by academic challenges that may not be identified by standardized testing.

Most research examining discourse abilities in children and adolescents with TBI has utilized narrative discourse (e.g., Brookshire, Chapman, Song, & Levin, 2000; Chapman et al., 2004; Chapman, Levin, Wanek, Weyrauch, & Kufera, 1998; Turkstra & Holland, 1998; Walz et al., 2012). Some studies (e.g., Chapman et al., 1998; Turkstra & Holland, 1998) have found that individuals with TBI show deficits in informational content of narrative stories, but not in linguistic measures of syntax, whereas other studies (e.g., Brookshire et al., 2000; Morse et al., 1999) have shown that, on narrative tasks, students with TBI also exhibit syntactic differences from peers without injury. Studies comparing narrative to expository tasks (e.g., Berman & Nir-Sagiv, 2007; Scott & Windsor, 2000) in children with TD or language disorders also suggest prominent differences in performance between these two genres. Thus, it appears that differences in performance are not simply related to the cognitive communication abilities of the participants, but also to the type of discourse being studied (e.g., narrative vs. expository).

Expository discourse has been examined in children with TBI in only two studies (i.e., Chapman et al., 2006; Hay & Moran, 2005). Hay and Moran (2005) found that children with acquired brain injuries (not limited to TBI), who also performed greater than 1 standard deviation below the norm on a test of language development, produced less language and demonstrated poorer recall of both narrative and expository (procedural) passages in a recall task than did peers with TD. Both groups demonstrated better performance on the narrative compared to the expository retell tasks. Chapman et al. (2006) found that students with both mild and moderate-to-severe TBI demonstrated poorer abilities to incorporate the overall main idea ("gist") in verbal summaries of a descriptive expository passage than students without TBI. In addition, working, but not immediate, memory abilities were correlated with performance on the summarization task, again indicating the importance of higher-level cognitive skills for this task. In summary, past studies have identified that children and adolescents with TBI may struggle with both narrative and expository discourse production but demonstrate genre-specific differences as well, though fewer studies have looked specifically at expository abilities in children with TBI.

Although various types of expository discourse are encountered in academic work (e.g., cause–effect, problem–solution, compare–contrast), prior studies of individuals with TBI utilized only procedural (Hay & Moran, 2005) and descriptive expository tasks (Chapman et al., 2006). Ward-Lonergan, Liles, and Anderson (1999) recognized the importance of investigating other types of expository discourse and examined how school-age students with typical language and those with language disorders retold two types of social studies lectures (compare–contrast and cause–effect). Students with language disorders performed more poorly on all outcome variables regardless of expository type when compared with students with typical language. But, regardless of language abilities, students showed more efficient recall of facts from the cause–effect lecture (e.g., included more content per utterance) but had greater productivity (e.g., more utterances) when retelling the compare–contrast passage.

Findings from the Ward-Lonergan et al. (1999) study are important for three primary reasons. First, students with language disorders demonstrated overall poorer performance when retelling both expository lectures, compared with students with TD. In addition, students with typical language development also demonstrated poor recall of content from the two expository lectures. These findings support past research (e.g., Scott & Windsor, 2000), indicating that expository discourse may be a particularly challenging discourse genre for all students, but specifically for students with language difficulties. Second, students in both language groups demonstrated differences in performance when asked to verbally retell two different types of expository lectures. Because students encounter many different types of exposition in the school curriculum, it is important for educators and clinicians to know that each type of exposition may place different demands on students. Third, students with language disorders showed the same pattern of performance as students with typical language when retelling these two expository lectures. Thus, the demand of the different types of exposition appeared to impact both groups of students similarly. Taken together, findings from this study reinforce past research (e.g., Nippold, Mansfield, & Billow, 2007) that distinct types of exposition may affect language performance differentially, yet currently, there is not sufficient evidence to explain why these differences might occur. Do different types of exposition require different cognitive or language skills? Do performance differences indicate that one type of exposition is more complex than another type? In addition, it is not known how students with TBI perform on other expository discourse tasks, or if different expository subtypes might pose distinct challenges for students with TBI. Yet, such information is needed if adequate supports are to be provided to affected students.

The purpose of this study was to gather preliminary data (a) identifying differences that might exist in the summaries of a small group of adolescents with TBI for two types of expository discourse (compare–contrast and cause–effect) and (b) comparing their performance to a larger group of adolescents who were typically developing. These discourse types were chosen for this study so that we could gather additional information about lesser studied, but academically relevant, expository types, but also to compare the performance of students with differing cognitive abilities. An overall summary quality score was determined for each verbal summary, which allowed a holistic examination of the summary produced by participants through inclusion of both macrostructural (text-level) and microstructural (sentence-level) scoring components. Two specific research questions were investigated:

1. For adolescents with TBI, do summary quality scores differ between two types of expository discourse?
2. Do summary quality scores of adolescents with TBI differ from those of adolescents who are typically developing on two types of expository discourse?

It was hypothesized that, similar to adolescents with TD, adolescents with TBI would show differences in their ability to summarize compare–contrast and cause–effect passages (Lundine, 2016). It was further hypothesized that adolescents with TBI would demonstrate lower discourse summary quality scores than adolescents with TD on both types of expository discourse examined in this study.

Method

This protocol was approved by the institutional review boards at The Ohio State University and Nationwide Children's Hospital prior to its initiation. Before enrollment, consent forms were signed by parents (or participants who were 18 years old), and assent forms were signed by participants below 18 years of age. All participants received a parking voucher and a gift card upon completion of the study tasks.

Participants

A partial waiver of consent allowed the researcher to use chart reviews to identify patients who were previously admitted to the rehabilitation unit of a local children's hospital who fit the following inclusion criteria: (a) hospital admission for moderate-to-severe closed head injury (as indicated by lowest recorded postresuscitation Glasgow Coma Scale Score [Teasdale & Jennett, 1974] of 12 or less or 13–15 with evidence of identifiable lesion on brain imaging; as used in prior studies by Tlustos et al., 2016; Wade et al., 2010; see Larabee & Rohling, 2013, for classification explanation), (b) age at injury of 9 years or more, (c) completion of at least the fourth grade prior to injury and seventh grade at time of testing, (d) at least 9 months postinjury to allow for stabilization of recovery, and (e) age at time of testing of 13–18 years. Individuals were excluded if English was not the primary language in their home; if there was documentation of presumed child abuse as the mechanism of injury; if there was documentation of severe motoric, speech, or language impairments that would render them unable to participate in testing; or if they had a documented history of autism, developmental delay, severe language impairment, or neurologic disorder (prior to hospitalization for TBI). Five adolescents with TBI were ultimately tested using the protocol described below. All five reported having a current Individualized Education Plan at school under the TBI designation. Demographics and injury information are included in Table 1.

Adolescents with TD (n = 50), enrolled as part of a larger study (Lundine et al., under review), are included in the present protocol as a comparison group for the adolescents with TBI. The participants with TD were between the ages of 13 and 18 years (M = 14.5 years, range 13.0–18.75 years). These individuals were recruited from the community and enrolled if they had completed seventh grade; were English-speaking; had no history of autism, developmental delay, severe language impairment, or neurologic disorder; and had never been hospitalized for a TBI. This

Table 1. Participant demographic and injury information.

Participant	Age (years)	Grade	Gender	Race	Time since injury (years)	Lowest recorded GCS	Mechanism of injury	Postinjury brain imaging results	Most recent neuropsychological testing results
P1	13.6	8	Female	Caucasian	1.3	7	MVA; rollover, ejected from backseat	CT: Bilateral frontal hemorrhages, right parietal and temporal hemorrhages, right temporoparietal skull fracture	Full Scale IQ = 89. Language skills intact with isolated weakness in naming; generally intact executive functions
P2	16.4	11	Male	Caucasian	4.2	7	MVA; ejected from car	CT: Nondepressed left temporal fracture, bilateral intraventricular hemorrhages, cranioplasty, right subdural and epidural hematomas. MRI: Diffuse axonal injury with encephalomalacia	Full Scale IQ = 71. Relative strengths in word knowledge, following directions, social skills and behavioral regulation; significant deficits in speech, motor skills, nonverbal reasoning
P3	18.0	12	Female	Mixed	4.2	3	MVA; ejected from car	CT: Small right subdural hematoma with mass effect and midline shift of 3.5 mm. MRI: Diffuse axonal injury, subdual and subarachnoid hemorrhages, evidence of cytotoxic edema	Full Scale IQ = 71. Processing speed low average; impaired working memory and verbal comprehension indices; low average on following verbal directions
P4	14.8	9	Male	Caucasian	0.9	7	Struck by/against object; bike vs. car	MRI: Extensive intraparynchemal hemorrhage likely indicating diffuse axonal injury, edema in left cerebral peduncle, small intraventricular and subdural hemorrhage	Full Scale IQ = 112. Average verbal comprehension and working memory indices; variable attention and slowed processing speed; deficits in cognitive switching
P5	17.3	12	Female	African American	2.3	3	MVA; car vs. pole, ejected from car	MRI: Intraventricular and subarachnoid hemorrhages bilaterally, diffuse axonal injury, hemorrhage along posterior midline, posterior corpus callosum and bilateral thalami	Full Scale IQ = 80. Average working memory index; below average processing speed and divided attention

Note. GCS = Glasgow Coma Scale; MVA = motor vehicle accident; CT = computerized tomography; MRI = magnetic resonance imaging.

group was 52% female and 12% ethnic or racial minority (African American or mixed race).

Assessment Procedures

Participants were tested by the first author in one session lasting between 45 and 60 min. Based on family convenience, sessions took place in a clinic treatment room at the local children's hospital or in a treatment room in the Department of Speech and Hearing Science at a local university. After explaining the study process, the examiner explained that a good summary includes main ideas and primary details but excludes irrelevant details, read the participants a summary of the movie Spider-Man (from IMDb.com), and asked them to demonstrate their understanding of the task by summarizing one of their favorite movies. All participants were able to summarize a favorite or recently watched movie and were given appropriate verbal feedback to reinforce their focus on main ideas and relevant details.

Discourse Samples

During the course of the assessment, participants watched two video-taped lectures (compare–contrast and cause–effect) on a 19-in. computer monitor, each about 5 min in length. Order of presentation was randomized to control for order effects. The lectures were adapted from a prior study (Ward-Lonergan et al., 1999; see Figures 1 and 2 for brief descriptions). Lectures were comparable based on commonly used linguistic measures (e.g., number of words/sentences/paragraphs, reading level) and analyzed using Coh-Metrix, an online computational tool that produces indices of the linguistic and discourse-related factors of a text (Graesser, McNamara, Louwerse, & Cai, 2004; McNamara, Graesser, McCarthy, & Cai, 2014; see Supplemental Material S1 for specific comparisons). Lectures were read by the same speaker, with a neutral background and no visual aids. The speaker spoke in a natural tone, but without overemphasis on words that may signal discourse type (e.g., "on the other hand" in the compare–contrast passage). After viewing each video lecture, participants were asked to verbally summarize it so that someone who had not seen the video would be able to learn all of the important parts of the lecture without the unnecessary details. The examiner allowed participants to speak uninterrupted, as long as they wished, and offered only nods of encouragement and confirmed that participants were finished if they did not clearly indicate this on their own. All discourse summaries were recorded using a digital voice recorder (Olympus model WS-823) and a digital high-definition video camera recorder (Sony model HDR-XR260V).

Cognitive and Expressive Syntax Testing

Following the viewing and summarizing of each lecture, participants also completed cognitive and expressive syntax testing in two blocks, the order of which was randomized and predetermined to reduce potential order effects. Table 2 shows scores from cognitive and expressive syntax testing for each of the five participants with TBI, as well as the mean and standard deviations of their age-matched control group on these same measures.

Cognitive Testing

Five subtests from the NIH Toolbox Cognition Battery (see Bauer & Zelazo, 2013; Weintraub et al., 2013) were used to measure cognitive abilities for this study. Cognitive testing took approximately 25 min in total, divided between two testing blocks. Five cognitive domains were assessed: executive function, episodic memory, processing speed, working memory, and attention. In addition to individual scores for each measure, the age-adjusted fluid cognition composite score (which includes the Flanker Task, Picture Sequence Memory Test, List Sorting Working Memory Test, Dimensional Change Card Sort Test, and Pattern Comparison Processing Speed Test; Weintraub et al., 2013) was generated through the NIH Toolbox Assessment Center (http://www.assessmentcenter.net/) and used as the measure of cognitive ability in this study.

For all participants except Participant 2 (P2), tests were administered per NIH Toolbox Cognition Battery guidelines, wherein participants responded to tasks either verbally, with the mouse, or using the left and right arrow keys on the keyboard. P2 was unable to isolate finger movement for adequate access to the arrow keys on the keyboard due to motoric impairments associated with his TBI. Therefore, accommodations for nonstandard administration were made to allow him to use two Big Buddy button switches (AbleNet, Inc., Model #56100) attached to a Hitch computer switch interface (AbleNet, Inc., Model #10034100) in place of the left and right arrow keys for three subtests: Flanker Inhibitory Control and Attention Test, Dimensional Change Card Sort Test, and Pattern Comparison Processing Speed Test (Weintraub et al., 2013). These modifications may "compromise validity by conflating speed of motor response with executive function-cognitive flexibility . . . because scoring is based on both speed and accuracy of response" (National Institutes of Health, 2012, p. 8). For the Picture Sequence Memory Test, instead of moving pictures into the appropriate order using the mouse, P2 provided verbal instructions regarding picture order to the evaluator who operated the mouse. Because P2 was able to verbally summarize the expository lectures presented to him and because his cognitive composite score was not included in any average measure of performance for all students with TBI, his data were included in this exploratory analysis only.

Expressive Syntax Testing

The measure of expressive syntax was each participant's standard score on the Recalling Sentences subtest from the Clinical Evaluation of Language Fundamentals–Fifth Edition (Wiig, Semel, & Secord, 2013a). This subtest has been used as a measure of expressive syntax in other studies examining expository discourse abilities (e.g., Nippold,

Table 2. Cognitive and expressive syntax scores for participants with traumatic brain injury (TBI) and the mean (*SD*) of the age-matched control group.

Participant	Cognitive composite score	Cognitive composite score of age-matched control group, *M* (*SD*)	Expressive syntax standard score	Expressive syntax standard score of age-matched control group, *M* (*SD*)
P1	99.1	103.1 (14.0)	10	10.8 (2.3)
P2	46.2[a]	102.8 (15.5)	7	9.7 (1.1)
P3	60.9	121.2 (18.9)	3	10.3 (1.9)
P4	89.9	105.0 (9.2)	10	9.7 (1.9)
P5	68.0	112.6 (20.9)	12	9.7 (1.4)

[a]As noted previously, adapted test administration was required for P2. Likely, overall cognitive score is negatively impacted by motor impairments, confounding scoring of particular subtests that included response time and accuracy in scoring.

Mansfield, Billow, & Tomblin, 2008, 2009), and performance on this subtest has been shown to have a positive, moderate correlation with core language performance (Wiig, Semel, & Secord, 2013b). Per test guidelines, it was administered in about 5 min.

Summary Transcription and Analysis

Three trained undergraduate Speech and Hearing Science students listened to and transcribed each verbal summary using the Systematic Analysis of Language Transcripts (Miller & Iglesius, 2010). The summaries were segmented into C-units, an independent clause, and any accompanying dependent (i.e., subordinate) clauses (Hunt, 1965). Following initial transcription, each transcript was reviewed once more, and any necessary corrections were made to C-unit divisions.

Reliability

Twenty-two randomly selected discourse summaries (20%; 11 each of compare–contrast and cause–effect), including those from both adolescents with and without TBI, were transcribed by a second individual to ensure accurate transcription of summaries via reliability comparisons. Point-to-point comparison was conducted to determine agreement on Systematic Analysis of Language Transcripts transcription conventions (e.g., C-unit segmentation, presence of a word). For compare–contrast and cause–effect transcripts respectively, agreement was 96% and 100% for occurrences of C-units, 96% and 100% for coding number of clauses within each C-unit, and 99.6% and 99.7% for perceptual agreement on presence of a word (e.g., in vs. on).

Summary Quality Scoring

The primary outcome measure for this study incorporated a holistic scoring rubric to rate summary quality. Scoring rubrics are ecological valid, are frequently used in academic settings (Koutsoftas & Gray, 2012; Westby, Culatta, Lawrence, & Hall-Kenyon, 2010), and incorporate macrostructural (text-level) analyses of discourse, such as main idea and content, which are critical for overall summary quality. A scoring rubric used in a prior study to evaluate written expository summaries (Westby et al., 2010) was adapted for this study of verbal expository summaries. The revised rubric for this study had five traits, each scored on a zero-to-four scale, for a total of 20 potential points per summary. Per Westby et al.'s (2010) divisions, two of the five traits included in this rubric addressed macrostructure: (a) gist, topic/key sentence, main idea and (b) text structure, and three addressed microstructure: (c) content (amount, accuracy, and relevance), (d) conjunctions and signal words to indicate subtype (e.g., "as a result" for cause–effect or "on the other hand" for compare–contrast), and (e) sentence structure. Supplemental Material S2 provides examples from the lowest and highest levels of the scoring rubric for each trait.

After participants' summaries were transcribed, two graduate students in Speech-Language Pathology, blinded to overall study hypotheses, were trained using test transcripts to use the adapted rubric. Raters were blinded to speaker demographics (including TBI/TD status), and transcript order was randomized within discourse subtype. Both raters independently scored all 110 transcripts for this study.

Reliability

After initial scoring of discourse summary quality, 96% of all individual and composite scores matched or differed by only one point across raters. Perfect agreement was achieved on 51% of scores and of the scores that differed, 91% of them differed only by one point. All disagreements were resolved through discussion by the two raters so that 100% agreement was attained for individual and composite discourse quality scores.

Analysis

Because of the small sample size in this exploratory study, it was not appropriate to use inferential statistics to compare performance between discourse types within the group of adolescents with TBI or to compare the performance of adolescents with TBI to peers with TD. Therefore, to determine whether summary quality scores differed between two types of expository discourse for adolescents with TBI, means and standard deviations were examined for overall summary quality scores and for the combined (compare–contrast + cause–effect) macrostructural (Traits A and B on the scoring rubric) and microstructural (Traits C, D, and E) components of the summaries. To determine whether or not there were differences in performance between groups, further descriptive comparisons were explored.

Results

Table 2 shows the results from cognitive and expressive syntax testing for all participants. Adolescents with TD showed cognitive and expressive syntax abilities within average limits across all age groups. Two participants with TBI also had cognitive composite scores that fell within average limits (P1 and P4), and four of five participants with TBI had expressive syntax scores that fell within average limits (all except P3).

Figures 1 and 2 provide an example of a compare–contrast and cause–effect summary from an 18-year-old female participant from each group. See Supplemental Material S3 for samples from the other four participants with TBI. For the five participants with TBI, descriptive statistics (see Table 3) showed that total summary quality scores were, on average, higher for verbal summaries of the compare–contrast lecture (M = 7.8, SD = 1.3) than for the cause–effect lecture (M = 6.6, SD = 2.9). In sharp contrast, the adolescents with TD demonstrated higher total summary quality scores for summaries of the cause–effect lecture compared to the compare–contrast lecture. In fact, 66% (n = 33) of participants with TD showed higher total summary quality scores on the cause–effect versus compare–contrast, 8% (n = 4) showed no difference, and 26% (n = 13) showed higher total summary quality scores on the compare–contrast lecture. This trend was reversed in the small group of participants with TBI, 60% (n = 3) of whom showed higher scores when summarizing the compare–contrast versus the cause–effect lecture.

Descriptive, between-group differences were noted on all key variables (see Table 3). When summarizing the compare–contrast lecture, adolescents with TBI had average total summary quality and macro- and microstructure composite scores 1 *SD* below their peers. When summarizing the cause–effect lecture, average performance of students with TBI was more than 2 *SD*s below their peers for total summary quality score and macrostructure composite and nearly 2 *SD*s below their peers for the microstructure composite. Closer inspection of individual data points (see Table 3) showed that only P4 had scores approximating his peers with TD.

Discussion, Future Directions, and Conclusions

This study examined the performance of a small group of adolescents with chronic TBI when asked to verbally summarize two types of expository discourse: compare–contrast and cause–effect. Their performance on tests of cognition and expressive syntax (see Table 2) was also investigated to explore the possible relationships that might exist between discourse summaries and these commonly used evaluation tools. In addition, all of these results were compared to those of a group of 50 adolescents with TD. There are three key findings from this study that warrant future investigation.

First, students with TBI demonstrated overall poorer performance, compared to students with TD, when asked to summarize both types of expository lectures. In addition and consistent with findings from Ward-Lonergan et al. (1999), participants in this study also demonstrated performance differences based on the type of expository passage they were summarizing. For students with TBI, lower overall summary quality scores were observed when they

Figure 1. Examples of a compare–contrast summary from a participant in each group.

<u>**Compare-Contrast Lecture:**</u> Main idea – There are several advantages and disadvantages to living in a Lifeland city. The lecture describes four main comparative relationships contrasting advantages and disadvantages of housing, education, employment, and population growth in Lifeland's cities.

Summary from 18-year-old female with typical development

The paper is of information on the living circumstances in the city of Lifeland compared to rural areas. It seems like there's more open space in rural areas. But in the cities it's very condensed, overpopulated. There aren't as many opportunities for people to go to post-secondary school after they go through the normal routine. And those who do seem to have good jobs. But it is explained that those who do not go far have to work in factories that aren't very accommodating to their workers and don't provide a lot of excitement for their workers or provide much of anything for them. And those who live in the city are not excited about more people moving in. Rather, they would like to encourage people to not come and condense their city more, due to environmental things, overpopulating. There's a lot of smoke and pollution and whatnot. But also because of jobs. And it's already competitive enough with getting their kids into schools. But it's clear that people in the city would like people to live in rural areas. It seems more open and better for living.

Summary from 18-year-old female with TBI

I learned about how the children want to quit a job or quit school because of all that's happening around the world now. And it's the police and teachers that are keeping the children in school. And some people keep the people in jobs to stay. So if they keep preaching this and telling everybody about this, I think a million of children will stay in school until they graduate. And that's the right thing to do because you don't want kids to fail school where they will never be able to get a job. So I'd tell them to stay in school because that's a smart thing to do.

Figure 2. Examples of a cause–effect summary from a participant in each group.

Cause-Effect Lecture: Main idea – Lifeland led the world in inventions during the 600-700's. The lecture presents four main causative relationships describing how the inventions in Lifeland affected other nations in four important areas: early inventions, shipbuilding, written language, and architecture.

Summary from 18-year-old female with typical development

Lifeland is considered a very desirable place for people to go due to many reasons. They've invented a lot of things that have become useful all around the world, such as their ships which they used to import and export goods. And people who are in part of the trade are usually really excited. So that is a big draw to Lifeland, is just to see the multitude of things that they've created and to experience where that's come. They've also created language and the way that it's written and recorded, which has impacted people all across the world, and how they record information and write things down and read. And then they also are very good architects. The Lifeland people have built a lot of amazing sites such as pyramids and other things. And that is another thing that draws people out of country to come visit this place called Lifeland.

Summary from 18-year-old female with TBI

The story was about a summary or that a young woman had made. It was about the sun and everything like that, about more like the weather and telling about how they used the strings and everything. She was telling a lot about how the strings hooked on to what and why and where, was what she was really telling me. But that's all I could say about…I can't remember everything from the story.

summarized the cause–effect passage compared to the compare–contrast. These findings add further credence to past studies (e.g., Nippold et al., 2007; Ward-Lonergan et al., 1999) that have shown differences when adolescents produce expository passages of different types. Thus, even within the expository genre, different types of exposition may place unique demands on students that result in performance differences. Further research is needed to clarify why these differences might exist.

A second important finding from this study relates to the performance of students from both groups on expressive syntax testing. A comparison of expressive syntax scores (see Table 2) highlights some important similarities between the two groups of adolescents involved in this study. With the exception of P3, the scores for participants with TBI were all within average limits (standard score between 7 and 10) or above average (P5: standard score > 10). Expressive syntax ability did not seem to differentiate the groups, consistent with previous suggestions that standardized tests of language may not identify students who struggle with discourse (Coelho, 2007; Cook et al., 2011). This is also consistent with past studies (e.g., Chapman et al., 1998; Turkstra & Holland, 1998) that showed no difference in syntax abilities for individuals with TBI compared to those without injury on discourse tasks.

Lastly, findings from this study reinforce that future investigation is needed to clarify the role of cognition in expository discourse tasks, especially as it pertains to students with potential cognitive communication impairments that may not be identified on standardized language testing. Adolescents with TBI who exhibited average cognitive abilities (cognitive composite > 85; P1 and P4; Table 2) showed the same overall pattern of performance as participants with TD: higher summary quality scores for cause–effect compared to compare–contrast. On the other hand, those participants with TBI who had below average cognitive scores (cognitive composite scores < 85; P2, P3, and P5) showed higher performance on compare–contrast summaries (see Table 3). (Note that for P2 specifically, his cognitive composite score was likely negatively impacted by motor impairments. However, his most recent neuropsychological testing [see Table 1] shows a Full Scale IQ score of 71, indicating below average cognition.) Although participants from both groups demonstrated average expressive syntax skills (except for P3 in the TBI group), participants with TBI who had below-average cognitive skills showed a performance profile that directly contradicted that of participants (with and without TBI) who had average cognitive abilities. That is, participants with intact cognition did better summarizing the cause–effect passage. Participants with

Table 3. Average total summary quality scores, macro- and microstructural scores (*SD*) for each expository sample for the participants with typical development (TD; *n* = 50) and with traumatic brain injury (TBI; *n* = 5) and individual scores for participants with TBI.

Participant	Total discourse summary quality score		Macrostructure (of 8 points)		Microstructure (of 12 points)	
	Compare–contrast	Cause–effect	Compare–contrast	Cause–effect	Compare–contrast	Cause–effect
TD, *M* (*SD*)	11.1 (3.0)	12.4 (2.8)	4 (1.3)	5.1 (1.3)	7.1 (2.0)	7.3 (1.7)
TBI, *M* (*SD*)	7.8 (1.3)	6.6 (2.9)	2.8 (0.8)	2.4 (2.1)	5 (.71)	4.2 (1.6)
P1	7[a]	8[b]	2[a]	5	5	3[b]
P2	8	5[b]	3	2[b]	5	3[b]
P3	7[a]	4[b]	2[a]	0[b]	5	4[a]
P4	10	11	4	4	6	7
P5	7[a]	5[b]	3	1[b]	4[a]	4[a]

[a]Indicates that scores are at least 1 *SD* below the mean score for adolescents with TD. [b]Indicates that scores are at least 2 *SD*s below the mean score for adolescents with TD.

impaired cognition, on the other hand, did better summarizing the compare–contrast passage.

The different profiles of performance seen in this study are in contrast to those of Ward-Lonergan et al. (1999), who showed that students with language impairments showed a similar performance profile when retelling cause–effect and compare–contrast passages as students with typical language development. If replicated in a larger study, these preliminary results support the hypothesis that students with TBI may be particularly vulnerable to the demands of expository discourse tasks because of the cognitive skills required for competent comprehension and production. The findings from this study suggest that overall cognitive abilities may play a particularly important role when students attempt to summarize expository passages. The construction–integration theory of comprehension (Kintsch, 1988) is one proposed theory modeling the relationship of discourse and cognition that may be particularly relevant as we move forward in our study of expository discourse. This theory postulates that listeners and readers must first form a coherent understanding of the linguistic information presented. Then, for deeper understanding, they must incorporate new knowledge with previously learned information, which requires higher-level cognitive skills, such as inferencing, generalization, and abstraction (Snyder & Caccamise, 2010). The performance differences found in this study infer that cognitive skills may be particularly important as students attempt to summarize expository passages, as the construction–integration theory suggests. At this time, future research is needed to help explain if these differences (or relationships) are due to the specific cognitive demands of each type of exposition. Perhaps comprehension and recall of a cause–effect passage rely more heavily on inferencing skills than that of a compare–contrast passage, for example. Alternatively, performance may be related to the complexity of the expository type, wherein the organizational structure of a compare–contrast passage might be more easily understood than a passage discussing causality. The preliminary results from this study emphasize the need for further research to explore the relationship of expository discourse production and comprehension to cognition and expository discourse type.

If replicated in larger studies, these preliminary findings have important diagnostic implications as we seek to better understand the cognitive communication demands of expository discourse. Educators and clinicians need better information about how those demands might vary based on type of exposition (e.g., compare–contrast vs. cause–effect) and how expository type might impact the performance of students with language or learning challenges. Furthermore, these results reinforce previous suggestions that if standardized language testing is the sole measure used to probe language abilities in students after TBI, students who may struggle to manage the language of the classroom may be missed and not qualify for supportive services.

To date, few studies have examined the performance of persons with pediatric TBI compared to peers without TBI on expository discourse tasks, despite the relevance of these tasks to academic success. In the two existing studies on that topic, children with TBI were found to produce fewer complex sentences and fewer words than children with TD on a procedural expository retell task (Hay & Moran, 2005). They also had significantly increased difficulty summarizing a descriptive expository passage compared to uninjured peers (Chapman et al., 2006). The current study reinforces these between-group differences and demonstrates for the first time generally poorer quality summaries produced by adolescents with TBI on both compare–contrast and cause–effect expository lectures compared to their peers with TD. More specifically, these findings support previous suggestions that the various types of exposition may place different demands on a speaker, listener, reader, or writer. Macro- and microstructural composite and total quality scores for cause–effect summaries produced by adolescents with TBI showed overall lower scores, averaging 2 *SD*s below the mean of the group with TD. Only one of five participants (P4) had scores approximating those of adolescents with TD.

Because interpretation of these findings is limited due to the small sample size and resulting lack of statistical examination, these results require replication with a larger sample of students with TBI. In addition, as in many studies of TBI, though all of these participants had a similar mechanism of injury, variation in the effects of TBI (as indicated by injury- and noninjury-related variables, neuropsychological testing, and the cognitive and expressive syntax testing used in this study) may limit later generalization to a larger sample of students with TBI. The size of this sample did not allow for the analysis of specific interactions or relationships that may exist between or among summary production quality in these two types of exposition, cognition, or language, as well as the role that age and socioeconomic status potentially play. However, these analyses should be considered in larger, future studies to help clarify which variables seem most fundamental for successful summarization of different types of expository material and to examine what other variables may impact performance. In particular, larger studies will allow us to examine more closely which cognitive skills might be implicated in specific expository summarization tasks and whether or not there are differences based on expository subtype.

This is the first study to compare the performance of adolescents with TBI on two different types of expository discourse. Despite offering only preliminary data, this study demonstrated for the first time that a small group of adolescents with TBI showed prominent differences in their abilities to summarize compare–contrast and cause–effect expository lectures, both between expository subtypes and when compared to adolescents with TD. Further work is needed to determine if similar differences exist among other types of exposition and to clarify why these differences might exist. Although the current study investigated production of expository discourse, comprehension of expository discourse is arguably as important, if not more important in the school curriculum. Additional studies that investigate comprehension of expository discourse in adolescents with

TBI, without the demands of language planning and execution, are warranted. Moreover, additional research should investigate which aspects of cognition (e.g., attention, working memory, inhibition, and processing speed) might be predictive of a student's performance on an expository comprehension or production task. In order to identify the foundational skills required for comprehension or production of academic discourse, we must clarify which cognitive skills might be called upon in these different tasks.

Knowledge gained from future studies expanding on the results from this exploratory work will provide a foundation upon which we may begin to understand how TBI or a certain constellation of cognitive communication impairments might affect a student's ability to comprehend and produce expository discourse of different types. This knowledge is needed in order to appropriately support and maximize the academic success of not only students with TBI but also those students who exhibit similar profiles of cognitive communication deficits and may be currently underserved.

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