

Critical Thinking Skills in an Oral Reading Comprehension Test: A Curious Case of the Individuals with Tourette Syndrome

Aileen C. Bautista
Rochelle Irene G. Lucas
De La Salle University, Manila, Philippines
aileen.bautista@dlsu.edu.ph

Abstract

Although a wealth of studies attempted to investigate the motor capabilities of the individuals with Tourette Syndrome (TS), little is known about the linguistic performance of the population in higher-order thinking skills in reading. Using the Fable Interpretation Test, this study explored the critical thinking skills of the individual with TS. In this cross-case analysis research, we invited seven participants from ages 9 to 40 from the Philippines. Their responses were recorded and analyzed through coding. The results revealed that regardless of age, the respondents displayed attenuation of the linguistic performance in their critical thinking skills as displayed in their oral test. Thus, we argue that the attenuation of the linguistic performance took place when oral reading was done. This confirms the past claims of various scholars that phonological decay in the Working Memory (WM) is one observed effect of the tics among the people with TS.

1 Introduction

Tourette Syndrome or TS is a neurodevelopmental disease that causes tics (DSM-5; American Psychiatric Association, 2013). These tics are “sudden, rapid, recurrent, nonrhythmic motor movements or vocalizations” (DSM-5, 2013, p. 82). They are also “involuntary [and] repetitive” (Jung et al., 2013, p. 1017). Further, TS is a “tic disorder” that is frequently diagnosed in childhood or adolescence (DSM-5;

American Psychiatric Association, 2013; Conelea et al., 2014). Also, its severity peaks in early adolescence (Greene et al., 2016).

Hirschtritt et al. (2015) reported that 85.7% of persons with TS have comorbidity, which explains why people with TS often have concomitant conditions such as ADHD, Autism Spectrum Disorder, and OCD (Hovik, 2017). Moreover, scholars claim that TS results in the dysfunction of the prefrontal cortex and the basal ganglia (Lavoie & O'Connor, 2013; Dye et al., 2016) and its neighboring regions (Jackson et al., 2010), including the circuits that link the striatum to the brain. These parts are described to oversee the short-term memory, and the retrieval of the phonological inputs in the working memory (Strand, 2008; Thibault et al., 2008), procedural memory (Clark & Lum, 2017; Takács et al., 2017), cognitive activities (Eddy, 2018) and is also suspected of having an impact on the indirect language processing (Legg et al., 2005). This is further supported by Wen et al. (2017) and Jung et al. (2013) when they proposed that TS is caused by a corticostriatal-thalamocortical malfunction, which is also involved in language learning. In addition, some scholars argue that the issue of language and cognitive processing is observed because of the faster decay of the phonological inputs in the working memory (Strand, 2008; Thibault et al., 2008). Hence, some pieces of information are forgotten faster.

In addition, this population’s basal ganglia and the other portions, which are also affected by their tics, may also display impacts on language

acquisition and learning. Since the parts are responsible for the implicit acquisition, storage, and retrieval of a range of sequential, statistical, or rule-like information in structure (Clark & Lum, 2017; Takács et al., 2017), it can be observed that people with TS may lack language skills and may have learning impairments because the brain areas associated with communication may be affected (De Nil et al., 2005).

In an attempt to determine the impact of TS on the linguistic aspect of the learners, several scholars investigated the linguistic capacity of individuals with TS. First, it has been established that, in general, there is more brain activity observed among the individuals with TS compared to the healthy control groups (e.g. Jackson et al., 2020; Neuner et al., 2012; Rae et al., 2020; Mielke et al., 2021). It seems that on the outside, they appear to be performing linguistic tasks, but much happens within them, as reflected in their brain activity.

Second, individuals with TS have no difference in terms of competencies compared to the healthy control group in consideration of their cognitive capacity (e.g. Kim et al., 2018; Mielke et al., 2021; Weingarden et al., 2018). In particular, the competence variation resides in the following: cognitive activities (e.g. Eddy et al., 2016; Takács et al., 2017; Eichele et al., 2016), cognitive processing, and cognitive to motor performance (e.g. Neuner et al., 2012). This suggests that based on the general competencies that display their capacity to communicate, it appears that they are on an equal footing with the typically developed persons. Despite the seeming advantage, most of these studies report that more brain activity is observed among the TS cohort, which demonstrated that to achieve an almost similar performance as the typically-developed cohort, much takes place in the brain to compensate for the affected parts because of the tics. However, there seems to be a dearth of a more comprehensive study that looks at the finer aspects of linguistic skills, which may provide a detailed linguistic description of the individuals with TS.

Furthermore, various studies have conflicting views about the population's capacities with TS regarding their strengths and challenges. For their strengths, some scholars claim that the TS cohort has cognitive advantages over the typically

developed cohort, and these advantages pertain to accuracy (Takács et al., 2018; Jackson et al., 2011; Mielke et al., 2021; Kim et al., 2018). However, in relation to the linguistic advantages, researchers emphasize that it is confined to speed only (Dye et al., 2016) in contrast to the cognitive advantages of accuracy. Based on these studies, the individuals with TS display attenuation in linguistic areas such as verbs, vocabulary, oral language production, reading comprehension, and syntax.

Meanwhile, cognitive and linguistic deficits are reported by a few scholars (Debes et al., 2011; De Nil et al., 2005; Van Borsel & Vanryckeghem, 2000; Legg et al., 2005; Dye et al., 2016). These limitations are associated with the learners' communicative competence with TS in general. Also, limited extant investigation the described the language capacity of the said population in their linguistic ability aside from the studies of De Nil et al. (2005), Van Borsel and Vanryckeghem (2000), and Legg et al. (2005). This indicates that there is preliminary study around linguistic performance for the individuals with TS, but all of these focused on the population whose first language is English alone.

Further, Van Borsel and Vanryckeghem (2000) expressed the need to administer a linguistic description to provide the population's needed assistance in various areas. Since most studies on TS delve into the motor, psychosocial, and motor capacity, it is significant to explore their linguistic capabilities, especially their oral reading comprehension skills. For Legg et al. (2005), these language testing at a high level may help them train themselves to become immersed in critical thinking.

Based on these, existing studies reported that the dysfluencies of the TS population involve fluency issues (Van Borsel & Vanryckeghem, 2000), lack of linguistic flexibility to manipulate a structure (Legg et al., 2005), and organizing and processing their linguistic output (Legg et al., 2005). However, due to the limited studies in line with these, it may be inconclusive to claim that these are true for all members of the population with TS.

1.1. The Current Study

In response to the reported gaps in the studies on the language description of the individuals with

TS, the current investigation seeks to describe the said population and their higher-order level skills as shown in their responses to various oral comprehension questions. This study is part of a bigger study that attempts to provide the description of the population's linguistic performance. In this current paper, we argue that the individuals with TS display attenuation in their higher-order oral comprehension skills due to their tics, which may affect the regions of the brain that oversee the higher-order skills. Also, we assert that the comorbidities greatly influence their critical thinking skills in oral reading. Although reading is a productive ability, there are instances where oral reading comprehension is being assessed, and Legg et al (2005) argued that such assessment, the individuals with TS displayed challenges especially when the questions involved high order thinking questions.

In the following parts of this paper, we present the study methods, the results and discussion, and the conclusion, including the study's implications.

2 Methods

2.1 Research Design

This study utilizes a case analysis approach, which allows close comparison of the cases and visualizes similarities and contrasts between cases (Mathison, 2005). It is beneficial in examining individual cases and how they are compared to others. Likewise, this facilitates a more precise articulation of the study's generalization.

2.2 Research Setting

Owing to the continuous tougher community quarantine due to the pandemic, we conducted online data gathering from December 2021 to January 2022; hence, Internet research employs various programs or websites to gather and retain data. The research used Zoom, *Google Meet*, *Facebook Messenger*, and *Google Mail*. Also, according to Christensen et al. (2015), using the Internet allows geographically distant informants to participate in a study such as this, inviting more participants.

2.3 Research Participants

The research participants are individuals from Tourette Syndrome association in the Philippines, which supports individuals with TS and their family members. They are from ages 9-to 40 years old from Luzon and Davao. In terms of gender, the current study accommodated all gender. However, the study got all-male respondents as almost all members in the said organization are male. Hallet (2015) described that most persons with TS are male compared to female. Thus, it is expected that more male participants were observed. Moreover, the participants reported to have no hearing problems and that their first language (L1) is preferably Filipino, and their second language (L2) is English. These criteria are commonly observed as selection criteria in studies on TS.

Nielsen et al. (2020) asserted that there is a need to investigate the different age groups with TS since there may be characteristics that may be similar regardless of age, even though the literature on the neurological and physiological reports that the tics usually wane during adulthood. Interestingly, their study showed that the brain network among the young participants appears to have "older" brain networks, and the adult participants have younger brain networks. However, even these authors emphasize that since TS may appear unpredictably and at various ages a person (Nielsen et al., 2020), it is essential to point out the importance of examining the different age groups. Diehl et al. (2014) also contended the same claims concerning the use of respondents in the different life stages in a special populations group such as TS. However, the wide range of the age group utilized in the current study may be a limitation due to the variation in this respect.

Because some respondents are under 18 years old, their parents were invited to join through Facebook chat and were informed of the study's purpose. The parents chose their preferred communication channels for the study: Zoom, Google Meet, or Facebook video chat. Moreover, an informed consent form in English and Filipino was distributed to the participants. Moreover, the participation of the parents was also voluntary, and their engagement was entirely optional. All

participants were allowed to withdraw from the study or test if they were uncomfortable.

The invitation to participate in the study and the orientation on this research was coursed through the organization for participants over 18. This organization caters to the individuals with TS and their family members. If the participants' parents are involved in the said group, the invitation was sent through them.

As all participants with TS are members of the organization and are presumed to have been diagnosed either by a neurologist or a developmental pediatrician with comorbidities such as ADHD, OCD, among others. Regarding their education, the participants may be homeschooled, enrolled in mainstream education, or at special education school.

The initial inquiry revealed that the participants of this investigation have the onset of tics that ranged from 7 to 12 years old; thus, the tics may not impact their pre-linguistic development.

In addition, participants A and C are children; B and D are adolescents; and E, F, and G, are adults. All of them are male and have vocal (oral) and motor tics with varying severity. Furthermore, all experienced being under medication, but some have decided to stop taking them. Only one participant is married, and the rest reside with their respective families. In addition, most participants have co-occurring conditions or comorbidity such as ADHD, asthma, stroke, and ulcer. Currently, participants A to D are studying at private schools, and F and G are employed. Only participant G is married.

According to Conelea et al. (2013), concentrating on children may restrict the investigation because data from teenagers and adults are needed to clarify whether cognitive capacities decline with age or remain constant. They emphasized that the condition is generally controllable in maturity.

All common co-occurring conditions were included in the study, such as ADHD, OCD, and physical comorbidities. Jung et al. (2013) suggested that various comorbidities may reveal different capacities of the individuals with TS. This means that these may have an impact on their linguistic capabilities. Therefore, including them may provide important information describing their oral communication skills.

In addition, a TS cohort is also prone to negative experiences, future fears, and interpersonal difficulties (Smith et al., 2015), making them hesitant to participate in studies. Thus, research on TS has included parental or relative participation to share their experiences and speak on behalf of the individual with TS, who are mainly minors (p. 610).

2.4 Research Instrument

The instrument we used was *The Fable Interpretation Test* of Legg et al. (2005). This test comprises five parts: 1.) oral reading of the fable; 2.) fable retelling; 3.) summarizing; 4.) justifying the main characters; 5.) extracting the moral. This test is vital in the study since it measures an array of oral comprehension skills such as understanding the information, note taking, simplifying information, higher-order processes, strategic competence, understanding and following oral instructions, and discourse competence (Legg et al., 2005).

2.5 Research Procedure

Pre-data gathering. We submitted the ethics forms to the university research ethics review committee, which the committee approved. Once we obtained the ethics clearance, we sent a formal invitation to the parents and the respondents 18 years old and above. Initial screening was conducted online to determine if the individuals may have hearing problems. In addition, the respondents were requested to sign the informed consent form after its contents were explained to them.

Actual Data Gathering. The actual data gathering was conducted for two hours, including a short interview for each participant. This took place from December 2021 to January 2022. During this session, the adults were permitted to sit beside their children.

For the Fable Interpretation Test, one researcher shared the screen online to display the PowerPoint presentation. The fable was shown during the oral reading part and removed when the respondents were asked to perform the various oral comprehension tasks. This procedure followed what was indicated in Legg et al.'s

(2005) data gathering procedure. In addition, follow-up interviews took place to understand some performances reflected in the assessment results.

2.6 Data Analysis

Two raters were invited to assess the story retelling. They analyzed the response based on the following: 1.) inclusion of the details from the actual fable (accuracy), 2.) observance of the sequential order, and 3.) the syntactic structure of the response. A data callback was conducted to see whether the findings were permitted to be reported by the participants. The findings were also explained to each participant. The results were also disclosed to the parents of children under 18.

3 Results

3.1 Oral Reading Test

Most participants did not report any difficulty with the oral reading of the passage. Meanwhile, one participant with asthma as a comorbidity was described as having difficulty reading orally because he was catching his breath while his motor tics forced him to sound like he was having an asthma attack. Hence, it was described as “long tics” by the raters. The raters agreed that there was nothing anomalous in the oral reading performance that can be considered a dysfluency or issue when it comes to oral reading. Also, although word repetition is deemed ordinary among the three participants, it is not deemed as a dysfluency since even typically developed speakers do this when reading a passage orally. This supports the claim of Van Borsel and Vanryckeghem (2000) that the tics do not automatically qualify for a speech dysfluency, as they can just be common stuttering akin to people with TS.

3.2 Story Retelling

All participants found this task challenging. For example, three respondents: one child, an adolescent, and an adult could not recall the events in the fable. Also, these three have varying

tic severity during the test. Further, two participants provided very few details about the fable, and one requested to pause for a few minutes before responding though he recalled very few details, albeit the pause.

It is essential to note that the story retelling task took place right after the oral reading of the fable. Also, no silent reading was done after the oral reading. Two respondents reported that they could not seem to recall many details because they were too focused on ensuring phonological accuracy or in making sure that they pronounce the words correctly when reading the fable. Hence, they admitted that they neglected to pay attention to the story's details.

3.3 Fable Summary

Interestingly, all participants displayed issues during the Fable Summary Test. For instance, one adult participant could not summarize the fable, whereas another adult participant, provided the moral of the fable instead of summarizing it. Then, the third adult participant failed to provide the main gist of the fable. Hence, it can be found that even the adult participants performed poorly in this test.

For the younger participants, only a few details were missing in their summary. The following parts of the summary are commonly absent among their summary: 1) “attempt at achieving the goal” and 2) “the direct consequence marking attainment or non-attainment of the goal.” Given the concerns on the summary, all the participants, whether adults, adolescents, and children, all failed to provide the gist of the fable.

3.4 Identifying and Justifying the Main Characters

All respondents provided the main characters in the fable, and they explicitly determined the main characters.

However, not everyone provided the correct explanation. One participant said that the main character is the rice field, which is an essential element in the fable. Hence, it was rated “incorrect.” Meanwhile, three participants provided explicit and intratextual justification. All based their justification on the text that they read. The typical answers were, “they are the only

characters in the fable.” However, all of these further lack substantiation; thus, only one participant provided the correct answer that reflects critical thinking among all the respondents.

It is surprising that one adult participant responded where the justification was excluded. In comparison to the children and adolescent participants, he was the one who did not justify his answer. When asked whether the test was challenging, he said, “no,” but his performance displayed otherwise. Also, it was observed that those participants with TS+ADHD appeared to have difficulty in answering this part of the test. For example, one child participant (A) displayed impatience in answering the questions. There were parts where he was sighing to show that he no longer liked answering the test. Meanwhile, two adults explained that they could not think of any explanation at that time since they could no longer remember the story's details. Since the text was read once through oral reading, the two argued that it was becoming difficult for them to recall the story details that they would use in their justification.

3.5 Identifying the Moral of the Fable

For this test, all participants displayed attenuation, as evidenced in their linguistic performance. Three participants failed to answer this part of the test because they no longer remembered the story's details. These are a child, an adolescent, and an adult. The child participant displayed disinterest in answering this part of the test by saying “ayoko na” (*I do not want to answer anymore*). Whereas the other two were honest in saying that they no longer remember the details of the fable at that point.

Meanwhile, Participant B attempted to provide an answer; however, no clear discussion was articulated. In addition, the caregiver interference was noticeable in the case of Participant B. However, albeit the attempt of the caregiver to assist, the answer remained unclear.

On the other hand, one adolescent provided an abstract moral, but it was deemed irrelevant by the raters. Meanwhile, two adults provided literal and intratextual responses, which reflected that the moral of the fable is solely based on what they can remember from the text, but there is no abstraction provided, which is a clear manifestation of a

honed higher-order thinking skills. Thus, all participants failed to display higher-order thinking skills in this part of the test.

Based on the feedback provided, two participants could not concentrate on responding to the test because they were distracted due to external noise. As a result, both participants display strong discomfort in answering the test because of the distraction. Also, for the same participants, including the child participant, the presence of their parents and other people distracted them as these people were also coaching them on the answers even though they were instructed not to. As a result, the test taker could not concentrate. Meanwhile, two of them experienced strong tics as the test progressed, whereas one reported that he had not experienced any tics during the test. However, despite that, he did not provide any answer in the last part of the test. It was also the case of one adolescent participant, whose response seemed irrelevant even when distracted and in a very conducive environment. Thus, attenuation in the linguistic performance was still observed in these two participants.

4 Discussion

The various areas described in the results affirm the postulations of Legg et al. (2005) that the individuals with TS demonstrate poor performance in tasks that require higher-order skills. In particular, the decline in the various areas measured, as evidenced in the Fable Interpretation Test, supports the claim of Legg et al. (2005) that the deficits brought about by the tics are evident in the linguistic performance of the individuals with TS. Similar to their claim and the assertions of Eddy et al. (2009), the decrease in the performance the said group may be related to the speeded phonological decay in the Working Memory. In this study, it is intriguing that since silent reading did not occur in the given task but instead an oral reading alone, the observable decay of the linguistic inputs in the working memory is undeniable.

In addition, the current research supports the postulations of the past studies that there is no correlation between linguistic performance and the tic severity (Conelea et al., 2014; Jackson et al., 2020). However, it bolsters the claims of Steinberg et al. (2013) that the individuals with TS

have negative perceptions about tics, which is related to their poor performance. In our investigation, the more the respondents became excited or anxious in various linguistic tasks, the more their tics were observed. However, the tics do not seem to correlate with their performance and the scores obtained. As reflected in the participants' scores, they did not perform well in the various tasks regardless of their reported tic severity. Hence, even those who said they seemed to experience no tics at all still displayed difficulty in the assessments.

Further, the behavior of the child participant in terms of his disinhibition, or the incapacity to screen one's inappropriate thoughts into words, supports the argument of Legg et al. (2005) that this behavior is typical among individuals with TS. This means that the behavior of poorly filtering the articulation of their thoughts through the appropriate language level is usually present among the TS cohort. However, not all participants of the current study displayed this behavior since some were capable of filtering their words.

In terms of the effect of the environment, it may have distracted the participants potentially which has an impact to their performance. Ambient noise contributed to the speeded phonological decay or faster forgetting of what was heard. However, since one participant was in a quiet environment he still displayed an inability to answer correctly, which simply shows that the current study's data is insufficient to claim that external factors such as the environment and parents may influence their linguistic performance.

5 Conclusion

The current study explores the linguistic capabilities of individuals with TS in the Philippines. Using a cross-case study, we used the Fable Interpretation Test of Legg et al. (2005). In addition, two raters were invited to analyze and assess the performance of the seven respondents, who are children, adolescents, and adults.

The findings reveal that there seems to be linguistic challenges based on their performance in the Fable Interpretation Test. The attenuation in their linguistic performance in the higher-order level of questions may be due to oral reading

instead of silent reading. Dye et al. (2016) contend that some tasks such as oral reading tap the Working Memory may display a speeded decay due to the tics that affect this memory. Hence, this reflects that the issues on the Working Memory may result in challenges in subsuming the information retrieved from this memory to the procedural memory and the other memory needed in high-order thinking skills (Thibault et al., 2008; Legg et al., 2005). Thus, the poor performance of the respondents in responding to the questions that involved high-order thinking skills may reveal issues in the basal ganglia and its neighboring region based on their linguistic performance. This is so since these parts of the brain are said to oversee the various memory systems in the brain (e.g. Dye et al., 2016; Baddeley, 2012; Baddeley & Loggie, 1999). Therefore, the findings of the current study support the claims of Legg et al. (2005) that individuals with TS displayed attenuation in performance on tasks that employ higher-order thinking skills as an effect of the tics in the basal ganglia region and its neighboring parts.

Also, it appears that the comorbidity, especially ADHD, may affect the linguistic capabilities of the said population. However, the study's findings do not show a correlation between the tic severity and linguistic competence.

Based on these, we recommend further scholarly exploration that will confirm the findings of this study using electroencephalogram (EEG), Magnetic Resonance Imaging (MRI), or electrocardiogram (ECG) to determine the brain activity of the individuals with TS, especially in the parts of the brain involved in the Working Memory.

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