Unlocking Reading Potential in Dyslexic Individuals: The Impact of Interactive Narrative and Intrinsic Motivation on Reading Comprehension



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Technology statement

In the process of working on my thesis, I utilized Grammarly, Quilbot, and chatGPT to help with spelling and grammar. Furthermore, I employed Natural Readers to help me re-read the content of my thesis.

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Abstract

Dyslexia is a lifelong learning difficulty that predominantly affects reading comprehension. People with dyslexia often avoid complex texts, leading to reduced motivation to read. However, dyslexic individuals often develop unique skills to navigate reading complexities. This study aims to examine the role of (interactive) narrative in improving their reading experience and comprehension and also taps into their strengths. This study also considers to what extent intrinsic motivation mediates the relationship between information format and reading comprehension. A quantitative study was conducted amongst adults with dyslexia (older than 18; N=49) using a 3x1 between-subjects design. Three information formats were created to educate about long COVID: interactive narrative – textual narrative - and expository text, where narrativity and agency were manipulated. Afterward, participants' reading comprehension was measured. It is predicted that an interactive narrative will yield the most intrinsic motivation and, thus, the highest reading comprehension among the conditions. On the contrary, this study found that an interactive narrative with limited agency may not be the best approach to improve comprehension among dyslexic adults. The findings also suggest that intrinsic motivation can positively impact reading comprehension among dyslexic adults. However, a more comprehensive understanding of the relationship between the information format and reading comprehension by adding moderators is necessary. To conclude, this research provides valuable insights into the potential benefits of narrative for dyslexic adults. It also highlights the need for further investigation into the role of varying agencies in interactive narrative as an intervention.

Keywords: Dyslexia, dyslexia strength, reading comprehension, narratives, interactive narrative, intrinsic motivation

Table of Content

Introduction 7

Theoretical Framework 9

2.1 Information Format(s) 10

2.2 Dyslexia and Reading Comprehension 11

2.3 The Role of Intrinsic Motivation in Relation to Reading Comprehension. 13

2.4 Effect of Information Format on Reading Comprehension 14

2.4.1 Textual Narrative versus Expository Text 14

2.4.2 Interactive Narrative versus Textual Narrative 16

2.5 Effect of Information Format on Intrinsic Motivation 19

2.5.1 Textual Narrative versus Expository Text 19

2.5.2 Interactive Narrative versus Textual Narrative 20

2.6 Effect of Information Format on Reading Comprehension through Intrinsic Motivation. . 22

Methods 23

3.1 Design 23

3.2 Participants 24

3.3 Materials 25

3.4 Pre-test 28

3.5 Measures 29

3.5.1 Dependent Variable 29

3.5.2 Mediating variable 29

3.5.3 Manipulation check 30

3.5.4 Confounding Variables 31

3.6 Procedure 31

3.7 Data analysis 32

Results 32

4.1 Assumption checks 32

4.3 Manipulation checks 33

4.3.1 Perceived narrativity 33

4.3.2 Perceived agency 35

4.4 Hypothesis Testing 35

4.4.3 Hypothesis 3: Higher intrinsic motivation will result in higher reading comprehension 36

4.4.4 Hypothesis 4: The information format has an indirect positive effect on reading comprehension through intrinsic motivation; such that reading comprehension and intrinsic motivation are the highest for the interactive narrative, followed by the textual narrative followed by expository text 37

4.5 Exploratory Analyses 37

Discussion 39

5.1 Limitations and Future Research 44

Conclusion 45

References 46

Appendix A 54

Appendix B 66

Appendix C 72

Appendix D 76

Appendix E 77

Appendix F 77

Appendix G 78

Full survey 78

Appendix H 91

Appendix I 1

Introduction

Dyslexia is a learning difficulty that affects an individual's ability to read, irrespective of their intelligence or level of education (Brèthes et al., 2022; Kumar & Kaur, 2019; Wang et al., 2017). It encompasses challenges with decoding words, recognizing text, and text comprehension. Dyslexia also impacts phonological processing and working memory, leading to reduced reading fluency and comprehension (Bartlet et al., Hatcher & Snowling, 2002; Ransby & Swanson, 2003). Moreover, individuals with dyslexia often avert complex texts due to the taxing decoding process compounded by their difficulties (Shaywitz, 2003; Eide & Eide, 2011). This aversion to text affects their comprehension and higher-level cognitive processes, diminishing their intrinsic motivation to read (Eide & Eide, 2011; Hatcher & Snowling, 2002).

Even into adulthood, individuals with dyslexia continue to face reading challenges and are prone to losing motivation (Chakraborti-Ghosh et al., 2010; Wang et al., 2020), leading to a further reluctance to engage with reading material (Shaywitz, 2003). Despite efforts to address their word decoding difficulties, persistent text avoidance and demotivation issues remain prevalent (Ward et al., 2012), particularly with lengthy texts such as educational materials (Eide & Eide, 2011; Shaywitz, 2003). Furthermore, methods aimed at assisting people with dyslexia, like repeated reading, are often tedious and demotivating, contributing to disengagement (Cano et al., 2021). This underscores inherent issues within the reading process. Hence, there is a critical need for further research to develop effective interventions that can enhance the reading experience for individuals with dyslexia.

Despite these challenges, individuals with dyslexia often can transform their difficulties into strengths, cultivating unique skills that aid in navigating the complexities of reading (Davis & Braun, 2011; Eide & Eide, 2011). These acquired skills include heightened problem-solving

abilities, adept pattern recognition, visual-oriented thinking, and a holistic cognitive style (Davis & Braun, 2011; Eide & Eide, 2011; Stein, 2001). Moreover, research indicates that motivation, particularly intrinsic motivation, significantly improves reading comprehension among individuals with reading disabilities, including dyslexia (Logan et al., 2011; Sanir et al., 2002). This research has also underscored the pivotal role of engaging interventions in amplifying intrinsic motivation. Thus, tailoring information formats to accommodate the strengths and motivation of individuals with dyslexia can enhance their reading comprehension.

Narratives have features that may be argued to be beneficial in leveraging dyslexics' strengths, thus increasing their intrinsic motivation in reading. In particular, textual narrative has been shown to boost the intrinsic motivation of individuals with dyslexia, especially when tackling intricate materials (Shaywitz, 2003; Sáenz & Fuchs, 2002; Ward et al., 2012). Textual narrative also possesses properties that may leverage dyslexic strengths, such as strong chronological causal linked events, characters overcoming conflicts, and detailed descriptions of characters' appearance, objects, and actions (Bordwell, 2013; Graesser et al., 1994; Smed et al., 2021). Therefore, it could evoke relatability, vivid mental imagery, and emotional resonance (Clinton et al., 2020; Mar et al., 2021; Smed et al., 2021). Due to these properties, it emerges as a beneficial tool that can leverage dyslexic strengths, improving memory retention and overall comprehension (Eide & Eide, 2011; Stein, 2001).

While literature specifically focusing on adult dyslexic populations is limited, some studies have emphasized the significance of intrinsic motivation in enhancing reading comprehension among individuals with learning disabilities, including dyslexia (Logan et al., 2011; Sanır et al., 2022; Sáenz & Fuchs, 2002; Primor et al., 2011). One study, in particular, contrasts the impact of information format (textual narrative vs. expository text) on reading

comprehension, concluding that textual narrative is more effective (Sáenz & Fuchs, 2002). Other research explores intrinsic motivation's role as a mediator, finding it to be a good predictor of reading comprehension (Logan et al., 2011; Sanır et al., 2022). However, these studies do not exclusively focus on dyslexia, emphasizing the potential for exploring more engaging interventions. Building on this understanding, it becomes imperative to investigate the potential role of interactivity within narrative formats in further enhancing motivation for the dyslexic adult population.

In a study conducted by Gooch et al. (2016), the researchers explored the impact of gamification on dyslexic children's motivation and learning outcomes through interactive elements. Their findings suggest that gamification can effectively enhance the motivation and reading comprehension of dyslexic children, fostering a more positive attitude toward reading. However, it remains uncertain whether incorporating interactive elements into educational materials for dyslexic adults would yield similar benefits. This research seeks to expand upon existing studies by investigating the potential role of intrinsic motivation as a mediator between information format and reading comprehension. Specifically, it aims to examine how narrative and interactive features can enhance intrinsic motivation and ultimately lead to improved reading comprehension. Consequently, the research question that arises can be formulated as follows:

> RQ: *To what extent does the (interactive) information format affect reading comprehension among dyslexics? And to what extent is this effect mediated by intrinsic motivation?*

Theoretical Framework

This section will first cover the different information formats in this study. Following this, the focus will shift to articulating the conceptual model, explaining the relationships

between dyslexia, narrative, and the dependent variable, reading comprehension. The literature will support these relationships, aligning with the formation of hypotheses. Then, the role of the mediator—intrinsic motivation—between information format and reading comprehension will be explained.

2.1 Information Format(s)

Communication relies heavily on written text as a primary means of conveying information (Carlsson, 2019). Typically, written text can be categorized into two main types: expository and narrative (Mar et al., 2021). Expository text is designed to inform readers about a particular topic by presenting factual information (Graesser et al., 1991; Medina & Pilonieta, 2006). It usually follows a structured approach resembling a pyramid, starting with an introduction of the topic followed by further elaboration, often supported by arguments (Mar et al., 2021). Common examples of expository text include essays, manuals, and textbooks. On the other hand, narrative is a form of communication that involves recounting a series of events or experiences in chronological order, with the aim of captivating the audience through storytelling (Weaver & Kintsch, 1991). A narrative usually revolves around a central goal and features a main character experiencing conflicts, that may be followed by rising tension (Sanford & Emmott, 2012). Textual narratives can be analyzed at both the story and discourse levels (Kinnebrock & Bilandzic, 2006), where the story refers to the sequence of events, and the discourse pertains to how the story is presented.

In addition to textual narrative, interactive narrative is gaining prominence as an evolving storytelling form (Roth, 2016). Interactive narrative incorporates the added element of interactivity, transforming readers from passive observers into active participants capable of

modifying narrative aspects (Smed et al., 2021). These modifications arise from significant choices made by the reader, leading to noticeable outcomes (Murray, 2017)—a phenomenon commonly known as agency (Roth & Koenitz, 2016). Agency plays an essential role in interactive narrative, as it can influence significant aspects of the story, such as the narrative outcome and different points of view when experiencing a narrative (Schneider et al., 2018; Roth & Koenitz, 2016). Through this agency, the reader can influence the aforementioned elements of choice and outcomes.

According to Roth and Koenitz (2016), agency in interactive digital narratives is determined by three key factors: autonomy, effectance, and usability. Autonomy refers to the number of choices available to the user, while effectance measures how these choices impact the narrative in a meaningful way. Usability, on the other hand, evaluates the ease with which users can navigate the narrative, make choices, and achieve their objectives. It encompasses aspects such as learnability, efficiency, memorability, error prevention, and user satisfaction. Although 'agency' and 'effectance' are sometimes used interchangeably in the literature, for consistency, the author of this thesis will exclusively use the term 'agency' throughout the remainder of this thesis.

2.2 Dyslexia and Reading Comprehension

As we delve into various methods of presenting information, it's crucial to consider how the way information is shared impacts our understanding of text. It's also essential to acknowledge that a specific group frequently encounters difficulties in reading comprehension: individuals with dyslexia.

Dyslexia is a neurodevelopmental disorder that affects individuals' ability to read, write, and spell (Brèthes et al., 2022; Wang et al., 2017). It primarily impacts an individual's reading ability, making it challenging to recognize and decode words accurately and fluently. Consequently, people with dyslexia struggle with reading fluency and overall reading comprehension (Hatcher & Snowling, 2002; Ransby & Swanson, 2003). According to Hatcher and Snowling (2002), individuals with this condition also experience difficulties with their working memory, which tends to be weak. Unfortunately, dyslexia is a lifelong condition (Chakraborti-Ghosh et al., 2010). Research has found that adults with dyslexia are more prone to losing motivation to read and more likely to avoid reading, even after addressing their word decoding issues (Shaywitz, 2003; Ward et al., 2012). This problem becomes more pronounced, especially when the individual is faced with intricate, lengthy texts (Eide & Eide, 2011; Shaywitz, 2003), such as educational material (Panel, 2000). This demotivation and aversion may stem from the slow, laborious, and tedious process of decoding complex text, compounded by their difficulties (Eide & Eide, 2011; Hatcher & Snowling, 2002). Moreover, many techniques designed to aid individuals with dyslexia, such as repeated reading, can be monotonous and discouraging, leading to increased demotivation (Cano et al., 2021).

Despite the challenges confronted by individuals with dyslexia, they often develop unique cognitive abilities to handle reading (Davis & Braun, 2011; Eide & Eide, 2011; Stein, 2001). It's important to note that these strengths can differ among those with dyslexia. Firstly, they can excel in visual and pattern recognition, which aids problem-solving and suggests a preference for visual thinking (Davis & Braun, 2011). Consequently, they often rely on mental imagery, spatial arrangements, and visual patterns to understand information (Stein, 2001). Additionally, their unconventional thinking pattern fosters creativity, offering a distinct

perspective (Eide & Eide, 2011; Stein, 2001). This holistic thinking approach, often described as 'big-picture thinking,' inclines them to grasp overall contexts, recognize connections, and understand system structures (Davis & Braun, 2011; Eide & Eide, 2011)..

Despite the challenges confronted by individuals with dyslexia, they often develop distinct cognitive skill sets to navigate the reading process (Davis & Braun, 2011; Eide & Eide, 2011; Stein, 2001). It's crucial to recognize that these cognitive strengths can vary among dyslexics. Firstly, they can cultivate exceptional visual and pattern recognition abilities, contributing to superior problem-solving skills and indicating a preference for visual thinking (Davis & Braun, 2011). Consequently, individuals with dyslexia frequently rely on mental images, spatial arrangements, and visual patterns to comprehend information (Stein, 2001). Additionally, their unconventional thinking patterns foster a unique perspective, thereby enhancing creativity (Eide & Eide, 2011; Stein, 2001). This holistic thinking approach, often described as 'big-picture thinking,' inclines them toward understanding overall contexts, recognizing connections, and grasping the structure of systems (Davis & Braun, 2011; Eide & Eide, 2011).

2.3 The Role of Intrinsic Motivation in Relation to Reading Comprehension.

While there are two types of motivation, extrinsic and intrinsic motivation (Deci & Ryan, 2002), studies have suggested that intrinsic motivation holds greater significance for enhancing reading comprehension in dyslexic individuals (Logan et al., 2011; Sanir et al., 2022). Intrinsic motivation is the internal desire for satisfaction and enjoyment derived from an activity rather than external rewards (Deci & Ryan, 2002). It has been observed that intrinsic motivation is a strong predictor of reading comprehension (Logan et al., 2011; Sanir et al., 2022). However, both studies involved participants with various learning disabilities, such as autism and ADHD, and

focused on individuals within a younger age range, including elementary school students. Additionally, neither study used narrative as an intervention and emphasized the importance of exploring more engaging interventions. Nonetheless, one study has investigated the use of textual narrative compared with expository text and its effect on reading comprehension among individuals with learning disabilities (Sáenz & Fuchs, 2002). Textual narrative appears to be more effective in enhancing reading comprehension. However, it remains uncertain whether the same results would be achieved in this study context. Building on this understanding, it becomes imperative to explore the potential role of engaging information formats in further enhancing motivation for the dyslexic population.

2.4 Effect of Information Format on Reading Comprehension

2.4.1 Textual Narrative versus Expository Text

Mar et al. (2021) conducted a meta-analysis revealing that memory and reading comprehension are higher for textual narratives compared to expository texts. One key reason is attributed to the use of chronologically ordered causal actions (Graesser et al., 1994), where conflict is typically introduced at the beginning, tension rises in the middle, peaks during a climax event, and concludes with the conflict resolved and tension reduced (Smed et al., 2021). These conflicts often mirror the challenges individuals may encounter in their everyday lives (Mar et al., 2021). This structure offers a framework to organize information, making it easier for individuals with dyslexia to follow the story flow with their holistic thinking style. Furthermore, the narrative becomes more relatable when readers can establish a connection between the story's conflict and the challenges they may personally overcome (Clinton et al., 2020).

In this study, the textual narrative has been developed to mimic real-life conflict by describing a day in Alex's life. Alex is a young boy navigating through his day to resolve a conflict (preparing his school presentation) and understand his mom's difficulties dealing with long COVID. This kind of connection with the character can be argued to aid the textual narrative's ability to evoke emotions (Kinnebrock & Bilandzic, 2006), which plays a vital role in shaping our memory (Hamman, 2001). The notion of "flashbulb memories" (Winograd & Neisser, 1992) emphasizes how emotionally charged events leave a lasting impression on our minds because emotional material is given priority during attention and perception. This focus on the role of emotion in memory is particularly significant for individuals with dyslexia, who may experience vulnerabilities in their working memory, particularly in phonological working memory (Bartlett et al., 2010; Hatcher & Snowling, 2002). Involving emotion and relatability in the process may improve memory retention and recall by amplifying attention through a strong emotional response, thus facilitating easier information encoding and potentially leading to enhanced reading comprehension.

Research suggests that when readers engage with a textual narrative, they actively interpret its contents and generate vivid mental images of the unfolding narrative, making the experience immersive (Bilandzic & Busselle, 2017). As readers visualize the story's world, including characters, objects, and actions, they form vivid imagery. Dyslexic individuals, who naturally lean towards visual thinking (Davis & Braun, 2011), can use this strength to better comprehend the textual narrative. By leveraging visual-oriented thinking, they can more effectively imagine the experience of having a loved one with long COVID. Johnson and Rosenbaum (2015) support this notion, arguing that developing vivid mental imagery not only boosts engagement but also helps retain the story's context. Therefore, enhancing mental imagery

through narrative could be a valuable strategy to improve memory retention and reading comprehension for individuals with dyslexia.

2.4.2 Interactive Narrative versus Textual Narrative

Expounding on the discussed advantages of textual narrative, interactive narrative text holds the potential to further engage dyslexic readers. It's crucial to emphasize the role of agency in interactive narrative, enabling readers to smoothly transition from a passive experience to active involvement with the subject matter, achieved through increased agency. This notable shift actively engages readers in the narrative, ultimately enhancing comprehension and involvement (Smed et al., 2021).

Interactive narrative can be considered a form of active learning (Bransford & Schwartz, 1999; Prince, 2004; Winskell et al., 2019). Within the realm of active learning, students are encouraged to actively engage with and reflect on learning materials (Bransford & Schwartz, 1999). Interactive narratives often confront readers with embedded choices (Roth & Koenitz, 2016). Choice plays a pivotal role in encouraging active reflection on learning materials (Savani et al., 2017). With this in mind, harnessing the natural problem-solving and holistic thinking abilities of dyslexic individuals (Davis & Braun, 2011; Eide & Eide, 2011) becomes an intriguing prospect. When their holistic thinking and enhanced problem-solving skills are further stimulated, active engagement in reflecting on decisions and understanding consequences could significantly deepen their grasp of the story's underlying themes and messages, thereby enhancing comprehension.

Interactive narrative can be considered a form of active learning (Bransford & Schwartz, 1999; Prince, 2004; Winskell et al., 2019). Within the realm of active learning, students are

encouraged to actively engage with and reflect on learning materials (Bransford & Schwartz, 1999). Interactive narratives often confront readers with choices embedded in them (Roth & Koenitz, 2016). Choice plays a pivotal role in facilitating active reflection on learning materials (Savani et al., 2017). With this in mind, leveraging the natural problem-solving and holistic thinking aptitude of dyslexic individuals (Davis & Braun, 2011; Eide & Eide, 2011) becomes an intriguing possibility. In this regard, when their holistic thinking and heightened problem-solving skills are further encouraged, active involvement in reflecting on decisions and understanding consequences could significantly contribute to a more profound grasp of the story's underlying themes and messages, enhancing comprehension.

The presence of choice could also benefit dyslexic readers by offering them opportunities to pause. These pauses provide a temporary break in the influx of new information, allowing them to digest the content up to that point (Schneider et al., 2018). This approach provides dyslexic readers with a 'cognitive breather,' enabling them to approach the next passage with a refreshed working memory, or what Schneider (2018) termed 'reading with a fresh slate of working memory'. He also suggests that offering choices can actively reduce cognitive load, potentially leading to improved understanding and retention. This is particularly significant for readers with dyslexia, who often struggle with working memory (Hatcher & Snowling, 2002). By lessening their cognitive burden, individuals with dyslexia can allocate more mental resources to effectively comprehend the content. This observation aligns with Cognitive Load Theory (Sweller, 1988), highlighting the importance of reducing extraneous cognitive load to optimize comprehension.

Furthermore, in this study, the interactive narrative employs Alex's first-person perspective to narrate the story, along with second-person pronouns to address the reader. While Alex predominantly narrates in the first person, given that he uses "I" and "my" to convey his experiences, the interactive narrative also utilizes the pronoun "you" when addressing the reader, especially at decision points where the reader must make choices. According to Jahn (2005), the use of “you” in this context aligns with the definition of the second-person point of view. Using "you" enhances immediacy and fosters a personal connection with the story (Mildorf, 2012), thereby potentially making readers feel directly involved as one of the characters. This immersive experience may instill a greater sense of agency when facilitated through choice. When the reader perceives themselves as one of the characters, the choices presented to them take on added significance (Mildorf, 2012), resulting in a more interactive and participatory experience.

To further understand the benefits of interactive narrative, it is crucial to consider study findings on agency and reading comprehension within the context of the dyslexic population. Gooch et al. (2016) investigated the use of interactive elements through gamification with elementary students diagnosed with dyslexia, exploring its impact on motivation and reading comprehension. Gamification, like interactive narrative, provides users with a sense of agency through choices and immediacy via prompt feedback, often in the form of points or badges (Deterding, 2015; Rigby & Ryan, 2016). Gooch et al. (2016) suggest that gamification stimulates active engagement and significantly contributes to a deeper understanding and retention of information. Their study utilized a gamified learning platform, ClassDojo, to assist students in transitioning from primary to secondary school, aiming to motivate them in various subjects, including literacy, numeracy, and social skills. The findings underscored that gamification

stimulates active engagement and is pivotal in fostering a deeper understanding and retention of information, highlighting its potential benefits in educational contexts.

Analyzing the shared characteristics of gamification and interactive narrative, which foster a sense of agency and meaningful interaction with the story, suggests the potential for yielding similar benefits in promoting active engagement through interactive narrative. Additionally, interactive narrative can enhance the effectiveness of active learning by offering agency, notably, choices for dyslexic readers that could serve as a cognitive breather. Incorporating immersive experience and heightened engagement within interactive narrative may further enhance their potential. Following the interactive narrative, the textual narrative is expected to achieve higher comprehension scores than expository text due to their properties that can facilitate dyslexic strengths. Consequently, the first hypothesis can be formulated as follows:

> H1: Reading Comprehension will be highest for interactive narrative, followed by textual narrative, followed by expository text.

2.5 Effect of Information Format on Intrinsic Motivation

As we explore the impact of narratives on dyslexic readers, understanding intrinsic motivation becomes essential, as it may emerge as a critical factor shaping their reading experience and affecting their reading comprehension.

2.5.1 Textual Narrative versus Expository Text

Several reasons support the idea that textual narrative can boost intrinsic motivation, particularly for dyslexic readers. Firstly, the textual narrative has the ability to evoke enjoyment, even when it elicits negative emotions (Kinnebrock & Bilandzic, 2006; Nabi et al., 2006). Maslej

et al. (2020) further support this notion, suggesting that narrative can yield enjoyment, a crucial component of intrinsic motivation (Ryan & Deci, 2000). Moreover, the textual narrative in this study narrates the story from Alex's (the protagonist) first-person point of view, providing access to Alex's inner thoughts (internal focalization). This narrative technique may facilitate a deictic shift, temporarily allowing readers to adopt Alex's perspective (Duchan et al., 2012). Consequently, it may create a mental bond that enhances motivation to understand the story's context and facilitates learning (Greene, 2015). This is particularly advantageous for engaging dyslexic readers, who often experience demotivation when reading textual texts (Shaywitz, 2003; Ward et al., 2012; Chakraborti-Ghosh et al., 2010; Wang et al., 2020).

2.5.2 Interactive Narrative versus Textual Narrative

In the interactive narrative, the pillars of Self-Determination Theory (SDT) may be fulfilled as readers follow Alex's journey. Deci and Ryan (2002) proposed their SDT, asserting that certain basic needs—autonomy, competence, and relatedness—must be fulfilled for human intrinsic motivation to function optimally. Autonomy refers to the degree of control over one's actions, competence pertains to the feeling of capability, and relatedness involves the sense of connection to others. In essence, engaging in enjoyable activities, such as reading, is more likely to fulfill autonomy, competence, and relatedness, leading to more self-determined and intrinsically motivated behavior.

The reader also becomes an interactor as they shift from simply reading the story to actively engaging in the interactive narrative. Thus, the feeling of competence may be fostered as interactors make choices in the narrative, contributing to Alex's success. The relatedness need may also be met as the reader connects with Alex in a dialogue, becoming an integral part of the

story. The ability to make choices allows the reader to make autonomous decisions, satisfying the interactor's need for autonomy. As mentioned before, Deci and Ryan (2002) argue that satisfying all pillars increases intrinsic motivation. Therefore, by interacting with the interactive narrative, it can be predicted that the reader's basic psychological needs may all be met, potentially enhancing intrinsic motivation to continue reading.

Additionally, for dyslexic readers, the idea that satisfying all basic needs may increase intrinsic motivation is already explored in the study by Sanir et al. and Logan et al. (2022; 2011). Their study asserts that when readers with learning disabilities are engaged in reading activities that they find interesting and rewarding, they are more likely to feel a sense of competence, further boosting their intrinsic motivation to read. Likewise, interactive narrative has been explored as a potentially engaging format for learning educational content. Skains et al. (2021) aim to use the "No World 4 Tomorrow", an interactive narrative web-based program, to teach secondary school students about climate change. This study reveals that interactive narrative is an engaging format for learning about climate change since many students replayed the interactive narrative multiple times.

In conclusion, interactive narrative holds potential for meeting readers' basic psychological needs, thereby enhancing intrinsic motivation (Ryan & Deci, 2000). This format fosters a more engaging and enriching reading experience, potentially encouraging dyslexic readers to engage more with reading. Moreover, as indicated before, textual narrative evokes emotion and, therefore, enjoyment (Kinnebrock & Bilandzic, 2006; Maslej et al., 2020; Nabi et al., 2006), which are crucial components of intrinsic motivation (Ryan & Deci, 2000). The first-person point of view in the textual narrative can also further boost emotion by creating a mental

bond (Greene, 2015; Duchan et al., 2012). This is essential in reading for dyslexics because their challenge may be rooted in the reading process, which is frequently perceived as unengaging. Hence, the second and third hypotheses can be formulated as follows:

H2: Intrinsic motivation is highest for interactive narrative, followed by textual narrative, followed by expository text.

H3: Higher intrinsic motivation will result in higher reading comprehension.

2.6 Effect of Information Format on Reading Comprehension through Intrinsic Motivation.

The exploration of the relationship between information formats and reading comprehension through intrinsic motivation has progressed to the next phase of investigation. This phase involves assessing the effectiveness of narrative and the additional element of interactivity as interventions for dyslexic adults.

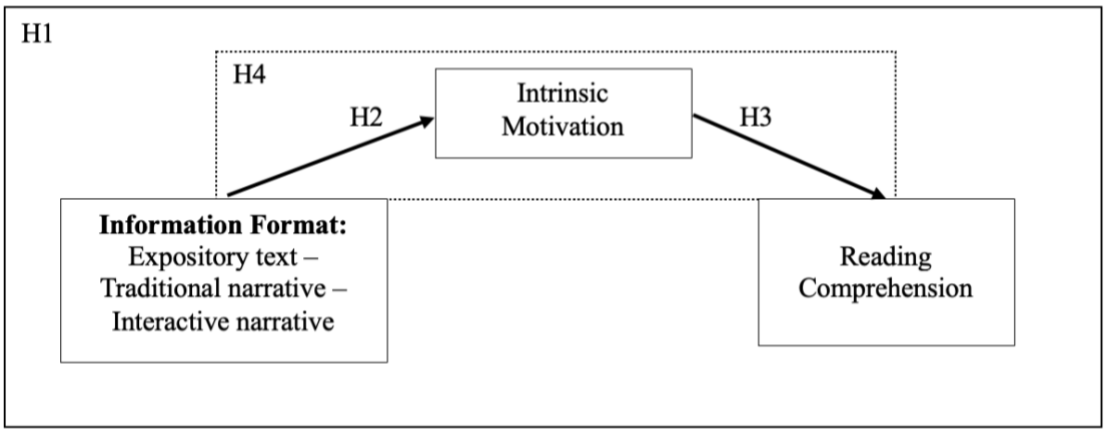
A limited body of literature directly addresses the dyslexic population, with recent studies (Logan et al., 2011; Sanır et al., 2022; Primor et al., 2011) shedding light on the crucial role of intrinsic motivation and the intricate relationship between different text formats and reading comprehension among individuals with learning disabilities. Supporting this notion, Gooch et al. (2016) suggest that dyslexic students experience more effective learning outcomes when the reading experience is enjoyable. These findings imply potential benefits for dyslexic adults when engaging with interactive narratives. This study aims to enhance the current understanding by exploring the underlying mechanisms that could leverage their strengths in comprehending textual information. Additionally, it seeks to investigate the relatively unexplored area of

narrative interventions and their effectiveness in enhancing reading comprehension among adults with dyslexia. Consequently, the fourth hypothesis is formulated as follows:

> H4: The information format has an indirect positive effect on reading comprehension through intrinsic motivation, where intrinsic motivation is highest for the interactive narrative, followed by the textual narrative, and finally, expository text, where intrinsic motivation positively affects reading comprehension.

Figure 1

The Research Model



Methods

3.1 Design

This quantitative experimental study made use of a 3x1 between-subjects design to investigate whether reading comprehension (DV) was positively affected by the information

format (IV: expository text – textual narrative – interactive narrative) and whether this effect was mediated by intrinsic motivation.

The ethical committee of Tilburg University (code REDC2020.172e) has approved this study. This study was collaboratively conducted with fellow student Eefje van Moorsel due to an overlapping research goal and target audience (i.e., dyslexic individuals). Eefje's research focused on exploring the impact of verbovisual narrative as an information format on reading comprehension, considering the mediating factors of self-efficacy and test anxiety. The collaboration involved developing key experiment components, including the expository text, textual narrative, information letter, preliminary questions, demographic questions, pre-test familiarity with long COVID, reading comprehension test, and the manipulation check.

3.2 Participants

Participants were gathered via Tilburg University's Human Subject Pool (HSP) and convenience sampling. On the HSP platform, Tilburg University students were contacted to participate in this study in exchange for 0.5 points of credit compensation upon participant completion. To improve outreach efforts, the researcher also distributed flyers at Tilburg University and other public places (such as public libraries) and recruited participants via the social media platforms WhatsApp, Facebook, and Instagram. Participants recruited through these means were not compensated.

In this study, a total of 77 participants entered the survey. Of those, 73 (94.8%) signed informed consent, and 49 (63.6%) people met the following criteria: (1) full completion of the survey, (2) being older than 18, and (3) having been diagnosed with dyslexia by a professional (not self-diagnosed). 28 (36.4%) out of 77 participants did not meet these criteria and were

therefore excluded from this study's analysis. Based on a power analysis (G∗power3, Faul et al., 2007), a sample size of 68 participants was required to achieve a statistical power of 80% with a medium effect size (d = 0.15) and an alpha of 5%. However, due to challenges in recruiting participants with dyslexia, the study had to proceed with a sample size of 49. This implies that the study was underpowered, increasing the likelihood of a type 2 error. Therefore, it was crucial to approach the interpretation of results with utmost caution.

Out of the remaining 49 participants, 27 were male (55.1%), 21 were female (42.9%), and one participant identified as a non-binary or third gender (2.0%). The majority of participants fell within the age range of 25-34. Participants were randomly assigned to one of the three conditions: 20 in the expository text condition (40.8%), 11 in the textual narrative condition (22.4%), and 18 in the interactive narrative condition (36.7%). Most participants were moderately familiar with long COVID (*N*=20, 44.9%), and most held a bachelor's degree (46.9%).

3.3 Materials

This study developed an educational text presented in three formats—interactive narrative, textual narrative, and expository text—as the independent variable. These texts aimed to inform and raise awareness about long COVID, with consistent content across all formats. The content was developed through desk research, drawing on insights from research organizations of long COVID and C-support (2023). The educational texts were embedded in Qualtrics, which served as the primary platform for data collection. Dyslexia-friendly fonts, as recommended by Rello and Baeza-Yates (2013), were also implemented. All textual materials are available in Appendix A.

3.3.1 Expository Text

The expository text format aimed to inform readers about long COVID, offering a thorough explanation supported by factual information and an overview of long COVID symptoms, risk factors, possible causes, and other supplemental details on the subject.

3.3.2 Textual Narrative

In the textual narrative format, readers were offered insights into long COVID by following a story about a day in the life of Alex, a young boy whose mother is grappling with long COVID. Alex was eager to create a school presentation about long COVID and seek assistance from his mother, who shared her symptoms, challenges, issues, and other information. Narrated from Alex's first-person POV, the story provided a more profound glimpse into his inner thoughts and daily experiences.

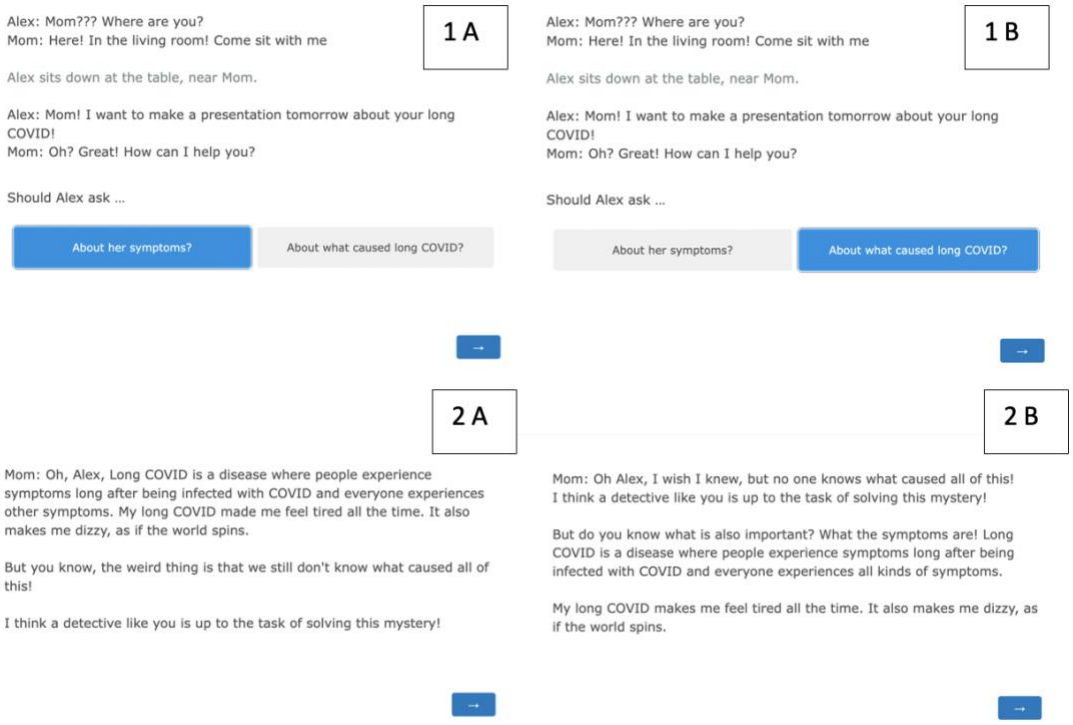
3.3.3 Interactive Narrative

The interactive narrative format prompts readers to transition from passive readers to active participants, or interactors, in the unfolding story. While the plot remained consistent with the textual narrative and was still conveyed through Alex's POV, the narrative now directly addressed participants as "you," involving them in crucial decision points. A deliberate use of a foldback structure was employed, offering limited choices (two to three options) at each decision point, ensuring consistent content and information flow while still preserving a sense of agency. Figure 2 shows an illustration of these decision points. This limited agency allowed participants to influence the character's journey by deciding whether Alex should ask his mom about symptoms or the cause of long COVID. Although these choices had a minor impact on the story, they contributed to the progress of the interactive experience. An example of limited agency can be seen in Figure 3, where participants were offered options to say “no” at one point but were

ultimately required to provide their “yes” to continue with the narrative, ensuring a balance between interactivity and narrative direction.

Figure 2

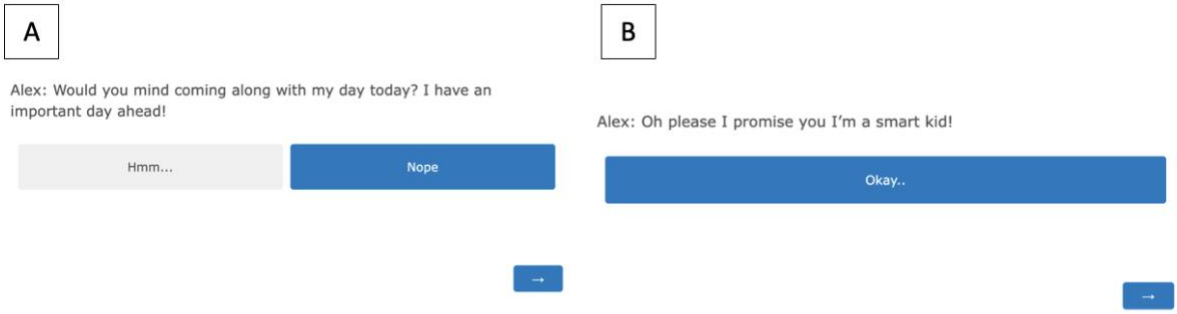
Illustration of Interactive Narrative Choices Embedded in Qualtrics.



Note. 1A & 1B) Reader's choice at each decision point, 2A & 2B) Different reader selections with consistent content.

Figure 3

Illustration of Limited Agency in The Interactive Narrative



Note. A) if participants choose no (nope), they will be directed to B) where they must comply to progress with the story.

3.4 Pre-test

To address the potential ceiling effect, an initial pre-test assessed participants' familiarity with long COVID before the main experiment. This pre-test was conducted with 18 non-dyslexic participants due to time constraints and difficulty finding dyslexic participants. Moreover, it was not deemed necessary to concentrate on dyslexic participants in this pre-test as its primary objective was to investigate the overall familiarity with long COVID. It is important to note that individuals who participated in the pre-test were excluded from the main study. The pre-test results showed limited awareness of uncommon symptoms and potential causes and risk factors of long COVID syndrome, despite recognizing common symptoms. These findings significantly influenced the development of experimental materials, ensuring the inclusion of previously unknown information in the educational texts. Further details about this pre-test can be found in Appendix B.

3.5 Measures

3.5.1 Dependent Variable

Reading comprehension was measured through a scale adapted from related studies on dyslexia and reading comprehension (Brèthes et al., 2022; Covali, 2016). Participants were presented with a series of comprehension questions related to the text on long COVID, encompassing both literal and inferential comprehension. Literal comprehension questions aimed to test the reader's understanding of explicit literal details, for example, "According to the text, what are the most common symptoms of the long COVID?". In contrast, inferential comprehension assesses the reader's capacity to connect the information they acquired in the text to their existing background knowledge, for example, "From the information provided about the theories concerning the causes of long COVID, what can be said about the potential impact of long COVID on the immune system?". A detailed listing of the comprehension questions and items is given in Appendix C.

3.5.2 Mediating variable

To evaluate intrinsic motivation, the study utilized the Intrinsic Motivation Inventory (IMI; Intrinsic Motivation Inventory, n.d.). The selection of relevant scales was guided by the inventory, specifically those aligned with reading activity-text material. The primary component of this measurement was interest/enjoyment, and the minor scale assessed perceived competence and autonomy. This selection was aimed to better align the study with the three key pillars of Self-Determination Theory (SDT; Ryan & Deci, 2002). Additionally, these items were recognized as positive direct predictors of intrinsic motivation.

To enhance clarity for dyslexic participants and minimize redundancy, some items, particularly those with similarities or overlaps with other scales like agency, were excluded. This resulted in three items assessing interest/enjoyment, two for competence and one for autonomy. All items underwent slight rephrasing to align with the study's context. Participants expressed their agreement using a 7-point scale (ranging from strongly disagree to strongly agree), with statements such as "This text holds my attention" serving as examples (refer to Appendix D for more details). Notably, the scale demonstrated decent reliability, $\alpha = .89$.

3.5.3 Manipulation check

To check whether the participants truly perceived the experimental condition (textual narrative and interactive narrative) as a narrative and the control condition (expository text) as not, perceived narrativity was measured. Participants were presented with the following yes/no question: "The information was provided in a story format."

The perceived agency was assessed to check whether the participants felt more agency in the interactive narrative condition compared to the other two conditions (textual narrative and expository text). One item was adopted from Klimmt et al. (2007), as it was tailored for the context of interactive narrative (Roth, 2016), which is directly based on the autonomy pillar of the SDT. This item was: "During the story, I felt like I was able to make choices that could influence the development of the story." The item was measured on a 7-point Likert scale ranging from 1 (‘Completely disagree’) to 7 (‘Completely agree’). For further details of the manipulation check items for both perceived narrativity and agency, please refer to Appendix E.

3.5.4 Confounding Variables

English proficiency was assessed to check whether language barriers could impact the results. Proficiency levels were measured using self-assessment. Participants were presented with the question: “Please select the category that best describes your level of English reading,” and presented with the choices: “Basic, Intermediate, Fluent.” Furthermore, participants' familiarity with long COVID was also assessed to check whether it impacted the results; a short questionnaire was administered that asked about participants’ knowledge of long COVID, their personal experiences with the condition, and their exposure to long COVID through their social circles. Details about both measures are presented in Appendix F.

3.6 Procedure

Once all participants were recruited, they were asked to fill in an informed consent form prior to the experiment. This form provided the participants with what was expected of them during the experiment, the general aim of the experiment, its data collection, and its potential risks. After receiving consent, participants were directed to fill in a survey on Qualtrics, which can be found in Appendix G. The first item of the survey covered a control question to ensure the participants were older than 18, followed by the self-assessment of dyslexia diagnosis to ensure that the participants were not self-diagnosed. Subsequently, participants were asked to complete the pre-test questionnaire about prior long COVID knowledge. They were also asked several demographic questions (e.g., gender and education level). After this necessary information was gathered, participants were randomly assigned to one of the three conditions (i.e., expository text, textual narrative, and interactive narrative). The participants were told there would be a test to assess their knowledge after the intervention. They were also told to proceed at their own tempo and that once they clicked “next,” they could not return to the previous steps. Participants

then filled in the reading comprehension and intrinsic motivation scales, respectively. Finally, perceived narrativity and perceived agency were measured as a manipulation check. At the end of the experiment, participants were debriefed about the study's true purpose and thanked for their participation.

3.7 Data analysis

The data was analyzed using the program SPSS (version 27). First, descriptive statistics were used to check the distribution of the data (i.e., normality, homogeneity). Then, a reliability test was conducted. A Univariate ANOVA and independent t-test were conducted to evaluate the success of the manipulations for perceived agency and narrativity, respectively. To test the hypotheses, a mediation analysis was conducted using Hayes' (2022) PROCESS macro model number 4. The independent variable was information format, and the analysis aimed to determine the mediation effect of intrinsic motivation on reading comprehension as the dependent variable.

Results

4.1 Assumption checks

Table 1 below provides an overview of the primary constructs measured in this study. Group differences, organized by condition, were assessed using a one-way ANOVA with Bonferroni correction.

Table 1

Overview of the Main Constructs.

Variable	Expository Text (control) (n = 20)	Textual Narrative (n=11)	Interactive Narrative (n=18)	p-value
	M (SD)	*M (SD)*	*M (SD)*	
Intrinsic Motivation	3.48 (1.29)	4.18 (1.12)	4.09 (0.80)	.042
Reading Comprehension	6.80 (1.88)	8.27 (1.42)	6.39 (2.23)	.136

The assumptions of normality and homogeneity of variances were checked before conducting the analysis. Violations were found for some variables: Education Level (kurtic), Intrinsic Motivation (skewed), and English proficiency (Kurtic when the 'basic' condition was removed). The detailed results can be found in Appendix H. The p-value might not be reliable; hence, bootstrapping was performed, and more weight was placed on the bootstrapped 95% confidence interval.

4.3 Manipulation checks

A manipulation check was done to check whether participants perceived the narrative texts (textual narrative and interactive narrative) as narratives and the expository text as not. In addition, whether the participants perceived more agency in the interactive narrative as opposed to the other two conditions.

4.3.1 Perceived narrativity

Participants were asked whether they perceived the information as a story, responding with a simple yes or no. A chi-square test of independence was not feasible due to some cell

values falling below 5 (see Table 2). Nevertheless, all the participants in the textual narrative and the interactive narrative conditions indicated that they experienced a story format, while the majority of participants in the expository text condition reported that they did not experience a story format. This is reflected in the frequency table (Table 3). Thus, it could be concluded that the narrativity manipulation was successful.

Table 2

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	37.745[a]	2	.000
Likelihood Ratio	46.354	2	.000
N of Valid Cases	49		

Note. 1 cell (16.7%) has an expected count of less than 5. The minimum expected count is 3.82.

Table 3

Frequency Perceived narrativity

	Was the information provided in a story format?		
	No	Yes	Total
Control	17	3	20
Narrative	0	11	11
Interactive	0	18	18

4.3.2 Perceived agency

To determine whether the manipulation of the perceived agency was successful, a one-way ANOVA with Bonferroni correction was conducted, revealing non-significant results ($F(2,46) = 1.21$, $p = .306$). On average, participants perceived the highest agency in the interactive condition ($M = 3.72$, $SD = 1.91$), followed by the narrative condition ($M = 3.55$, $SD = 1.13$), and lastly, the expository condition ($M = 3.00$, $SD = 1.17$). There were no statistically significant differences identified among the conditions: control vs. narrative ($M_{dif} = -0.55$, $p = .991$); control vs. interactive ($M_{dif} = -0.72$, $p = .417$); and narrative vs. interactive ($M_{dif} = -0.17$, $p = 1.000$). The results showed that perceived agency did not differ significantly between the interactive narrative and the other two conditions, indicating that the manipulation of agency was unsuccessful.

4.4 Hypothesis Testing

Model 4 of the PROCESS macro (Hayes, 2013) was used in SPSS to test the hypothesized mediation model with 5,000 bootstrap samples.

4.4.1 Hypothesis 1: *Reading comprehension will be highest for interactive narrative, followed by textual narrative, followed by expository text*

The mediation analysis showed that reading comprehension was the highest in textual narrative ($M = 8.27$), followed by expository text ($M = 6.80$), and lastly, interactive narrative ($M = 6.39$). The pairwise comparison indicated that the difference between expository text vs. textual narrative ($b = 1.47$, $SE = 0.73$, *BCa* 95% CI = [0.01, 2.93]) and textual narrative vs. interactive narrative ($M = 6.39$, $b = -1.88$, $SE = 0.74$, *BCa* 95% CI = [-3.37, -0.40]) was significant. However, the difference was insignificant for expository text vs interactive narrative ($b = -0.41$, $SE = 0.63$ *BCa* 95% CI = [-1.67, 0.85]). These findings revealed the observed mean difference in

reading comprehension between expository text and interactive narrative could not be considered statistically significantly different. Although it did not align with the anticipated hierarchy, where reading comprehension was expected to be highest for interactive narrative, followed by textual narrative, and then expository text, it supported the idea that reading comprehension was higher in textual narrative than expository text. As a result, H1 received partial support.

4.4.2 Hypothesis 2: Intrinsic motivation is highest for interactive narrative, followed by textual narrative, followed by expository text

The mediation analysis showed that intrinsic motivation was the highest in textual narrative (M = 4.18), followed by interactive narrative (M = 4.09), and lastly, expository text (M = 3.48). None of the pairwise comparisons indicated significant results (expository text vs. textual narrative (b = 0.70, SE = 0.41 *BCa* 95% CI = [-0.12,1.53] | expository text vs. interactive narrative (b = 0.61, t(48) = 1.71, SE =0.36 *BCa* 95% CI = [-0.11,1.32] | textual narrative vs. interactive narrative (b = -0.09, SE =0.42, *BCa* 95% CI = [-0.94, 0.75]). These findings revealed that none of the mean differences in intrinsic motivation could be considered statistically significantly different. As a result, H2 was rejected.

4.4.3 Hypothesis 3: Higher intrinsic motivation will result in higher reading comprehension

The results showed that the direct effect of intrinsic motivation on reading comprehension was significant, b = 0.84, t (48) = 3.62, $p < 0.01$, *BCa* 95% CI = [0.43,1.29]. Thus, H3 was supported.

4.4.4 Hypothesis 4: The information format has an indirect positive effect on reading comprehension through intrinsic motivation; such that reading comprehension and intrinsic motivation are the highest for the interactive narrative, followed by the textual narrative followed by expository text

The results showed none of the pairwise comparisons showed significant results: expository text vs. textual narrative, b = 0.59, *SE* =0.38, *BCa* 95% CI = [-0.14, 1.36] | expository text vs. interactive narrative, b = 0.51, *SE* =0.30, *BCa* 95% CI = [-0.04,1.13] | textual narrative vs. interactive narrative, b = -0.08, *SE* =0.34, *BCa* 95% CI = [-0.72, 0.63]. Thus, the indirect effect of the information format on reading comprehension through intrinsic motivation (mediator) was insignificant, and H4 was rejected.

4.5 Exploratory Analyses

It was essential to examine whether additional variables, such as English proficiency and familiarity with long COVID, may have associations with reading comprehension. To investigate this, a Pearson's correlation analysis was performed. Detailed results of this are given in Appendix I. The findings revealed a significant correlation between English proficiency and reading comprehension (r = .034, *BCa* 95% CI = [2.43,6.25], $p < .001$), while familiarity with long COVID showed no significant results. Due to the observed correlation, further exploration was conducted using Model 4 of the PROCESS macro (Hayes, 2013) in SPSS, with 5,000 bootstrap samples with English proficiency as a covariate.

Furthermore, a follow-up analysis was conducted, where participants identifying as 'basic' in English proficiency were excluded. This decision was grounded in the assumption that individuals with dyslexia who labeled themselves as intermediate or fluent in English may face

fewer challenges in comprehending texts due to their existing difficulties in reading and comprehension, especially in English. This exclusion increased ecological validity because people are more likely to read in their native language. Model 4 of the PROCESS macro (Hayes, 2013) in SPSS, with 5,000 bootstrap samples, was employed, using English proficiency (excluding basic) as a covariate.

Both analyses, focusing on English proficiency and English proficiency excluding 'basic' details and results, can be seen in Appendix J.

Table 3

A concise overview of the mean of intrinsic motivation and reading comprehension per condition.

	EN _ALL			**EN_PROF_NO_BASIC**		
Variable	Control *(n = 20)*	Textual narrative *(n=11)*	Interactive Narrative *(n=18)*	Control *(n = 17)*	Textual narrative *(n = 9)*	Interactive narrative *(n = 15)*
	M (SD)	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*	*M (SD)*
Intrinsic Motivation	3.47 (1.29)	4.18 (1.12)	4.08 (0.80)	5.29 (3.72)	4.46 (0.84)	5.43 (4.15)
Reading Compre-hension	6.80 (1.88)	8.27 (1.42)	6.39 (2.23)	7.24 (1.64)	8.44(1.33)	6.40 (2.38)

The results from Table 2 revealed a difference in the mean values among conditions for all participants (EN_ALL) (N = 49) and when individuals with basic English proficiency are excluded (EN_PROF_NO_BASIC) (N = 41). As can be seen, the mean of intrinsic motivation

and reading comprehension have increased across all conditions, notably the mean of the control group. The mediation analysis showed that including English proficiency (EN_ALL) as a covariate affected the result of the direct effect of information format on intrinsic motivation (H2), it became significant ($F(3,45) = 2.97$, $p = 0.04$, R-sq =0.17.). Particularly, the second hypothesis becomes partially supported, as it is in line with the prediction that interactive narrative will be higher than expository text, and their difference is significant ($b = 2.47$, $t(48) = 4.63$, CI = [1.40, 3.54]). This emphasized the increased relevance of considering English proficiency, particularly in affecting intrinsic motivation. The overall significance of all the other results remained the same, maintaining consistency with the initial hypothesis testing.

Upon including English proficiency without the 'basic' level (EN_PROF_NO_BASIC), the results did not significantly deviate from the initial analysis. Notably, the sample size decreased, raising the possibility that there might not have been a sufficient number of participants to demonstrate an effect. However, the observed increase in the mean of reading comprehension and intrinsic motivation across all conditions suggested that participants with a 'basic' level of English proficiency may have struggled with material understanding and engagement. This emphasized the crucial role of language considerations when testing the dyslexic population.

Discussion

This study aims to investigate the extent to which information format (interactive narrative – textual narrative – expository text) affects reading comprehension among dyslexic adults and to what extent this effect is mediated by intrinsic motivation. Notably, hypothesis one received partial support, demonstrating a significance albeit contrary to the expected outcome. The initial anticipation was that reading comprehension would exhibit the highest levels in the

interactive narrative, followed by the textual narrative and then the expository text. However, the results revealed a different hierarchy, with the textual narrative yielding the highest reading comprehension, followed by the expository text, and then the interactive narrative. Although the overall hypothesis was not fully supported, the findings align with the prediction that the textual narrative would yield a higher reading comprehension than the expository text.

The relatively low reading comprehension for the interactive narrative could be explained in multiple ways. Using the foldback structure in the interactive narrative may limit the perceived agency. This could be attributed to a specific segment within the interactive narrative, where participants felt compelled to provide affirmative responses for the narrative to advance, even if they were unwilling to assist the character, Alex. Despite expressing their disinterest in assisting, they were forced to respond positively, thereby diminishing their agency in shaping the plot. Detailed information on this aspect is provided in Appendix A, specifically in the section titled 'Decision Point 3.'

Secondly, limited agency and insignificant choices may have hindered active learning. As has been established by Prince (2004), active learning demands active engagement in the learning process and meaningful interaction for effective information processing. The insignificance of choice in the foldback structure might have led readers to become increasingly passive. As a result, this passivity may lead participants to click through without effort, indicating disengagement and a failure to learn actively. This lack of active engagement was evident in the duration of the interactive narrative condition. 7 out of 18 participants (39.2%) finished the survey in under 15 minutes - a relatively short duration, despite having to read through a multi-page interactive narrative.

Furthermore, the presence of choice in this study might not be helpful for dyslexic adults. Although choices were advocated before for their potential cognitive benefits for dyslexic readers, offering a cognitive break (Schneider et al., 2018), a study suggests the dual nature of choice in learning environments (Darejeh et al., 2021). According to Darejeh et al. (2021), the act of making choices itself could be cognitively demanding. Regardless of the significance of the choices (Kool et al., 2010). This effect may be particularly pronounced for dyslexic individuals who already struggle in information processing and text decoding. Therefore, the frequent appearance of choices in this study might have been counterproductive, contributing to further disengagement.

Moreover, the textual narrative presented a more familiar format. Dyslexic readers may face challenges in adapting to the novel format of interactive narrative, in addition to difficulties reading the text. Navigating through unfamiliar environments in reading demands cognitive effort (DeStefano & LeFevre, 2007). As proposed by Sweller (1988), the higher the cognitive demand, the higher the stress on working memory. It could be argued that the combination of novelty and inherent working memory limitation (Bartlett et al., 2010; Hatcher & Snowling, 2002) caused cognitive overload. Adding to this idea, a finding from Darejeh et al. (2021) also suggests that cognitive load could be higher for participants unfamiliar with the interactive narrative content. This study utilizes a relatively novel topic, long COVID, as the educational content. While this unfamiliarity was intended to reduce the ceiling effect, when combined with the novelty aspect of interactive narrative, it could pose an additional challenge for dyslexic participants. This rationale elucidates the observed result of higher reading comprehension levels in textual narratives compared to interactive narratives. Hence, it can be inferred that the use of a textual narrative format serves to mitigate cognitive load, thereby rendering the reading process

more manageable for individuals with dyslexia.

Lastly, as one could contend that textual narratives demand less cognitive capacity, it amplifies the strengths of individuals with dyslexia. This also aligns with previous studies that posit that narrative elements could enhance reading flow, evoke stronger emotion, and vivid mental imagery (Clinton et al., 2020; Mar et al., 2021; Smed et al., 2021). Therefore, this finding could underscore that an interactive narrative with a limited agency may not be the best intervention to leverage dyslexics' strengths.

Concerning the second hypothesis, it was anticipated that the intrinsic motivation would be the highest for interactive narrative, followed by textual narrative and, lastly, expository text. However, none of the pairwise comparisons between the conditions demonstrated a significant difference. Consequently, the second hypothesis was rejected. This discrepancy could be because expository text proves to be equally captivating for dyslexic readers compared to textual and interactive narratives. Expository text typically adopts a direct and concise presentation format. Dyslexic individuals are particularly susceptible to demotivation, especially when confronted with complex and lengthy text (Shaywitz, 2003; Ward et al., 2012; Chakraborti-Ghosh et al., 2010). Despite the argument that textual narrative is inherently more engaging (Mar et al., 2021), the length of the expository text itself (342 words) could win their motivation straight away, as it was significantly shorter than the textual narrative (744 words). Even though this study takes into account the presentation of the textual narrative by not serving it into one continuous block, the significant difference in text length may still exert an influence on reading motivation.

It seems possible that interactive narrative might be too distracting for people with dyslexia. Instead of being absorbed in the story and its characters, readers might be more

preoccupied with the interactive elements. This could be due to the novelty of using choices or simply trying to navigate around. Green and Jenkins (2014) support this perspective by arguing that adding choices to a story can “break the spell” and interrupt the reader's immersion in the story world. Therefore, it is recommended to use narrative or even expository text, which may reduce distraction and mental load, giving readers more space to comprehend the educational content of the text.

It is also important to note that the result of the second hypothesis may have been confounded by using the second-person pronoun 'you' in the interactive narrative. This raises a crucial question: does the use of 'you' contribute to a deictic shift, transforming the reader into a character, or is it solely the perceived agency (albeit limited) that turns the reader into an interactor? While I am inclined towards the belief that agency plays a more pivotal role in transforming the reader into an interactor, especially in making choices on behalf of the character, it is crucial to ponder this aspect. Therefore, comparing the two narrative formats in this study becomes challenging, prompting consideration for alternative approaches in future research.

Moving on to the third hypothesis, robust support is found with significant results indicating a positive relationship: higher intrinsic motivation corresponds to higher reading comprehension. This outcome aligns with prior research demonstrating a positive learning impact of intrinsic motivation on reading comprehension in both the general population (Wang et al., 2017) and learners with learning disabilities, including dyslexia (Logan et al., 2011; Sanir et al., 2022; Primor et al., 2011).

Regarding hypothesis four, it was initially expected that information format has an

indirect positive effect on reading comprehension through intrinsic motivation, where reading comprehension and intrinsic motivation are the highest for the interactive narrative, followed by the textual narrative and expository text. However, it did not find support. The absence of an indirect effect can be attributed to the nonexistence of a significant relationship between information format and intrinsic motivation, even though a connection exists between intrinsic motivation and reading comprehension. Regarding the pairwise comparisons, none showed significantly different means. Then, it can be suggested that the way the information is presented in this study may not affect dyslexic readers' motivation to read. It also seems possible that these results were due to overlooked potential moderators, such as types of dyslexia. Dyslexia has a broad spectrum that can greatly affect each individual's ability to comprehend narrative (Kuerten et al., 2019). For example, individuals with phonological dyslexia may find interactive narrative particularly beneficial. In contrast, those with double deficit dyslexia (the most severe type) may significantly struggle with interactive narrative due to their additional difficulties in rapid processing and multitasking. Therefore, the condition's impact may be equalized, resulting in no discernible effect.

5.1 Limitations and Future Research

It is important to acknowledge that the power analysis reveals a shortfall in the study, with only 49 participants instead of the initially required 68. This is attributed to challenges recruiting dyslexic participants within the specified time constraints. This study was also conducted in English, which overlooks the fact that many participants' primary language is Dutch. Additionally, being an online study, the lack of control introduces the potential for participants to utilize online resources, such as Google, and hampers the researcher's ability to provide immediate assistance or address additional participant queries. Furthermore, despite

some participants exceeding the study's expected duration by spending hours in the survey - deemed an outlier - they were not excluded from the analysis given the study's underpowered state. Additionally, this study faced a challenge in identifying whether a deictic shift that transforms the reader into a character occurs solely based on the perceived agency or the use of "you" when addressing interactors.

Future studies should enhance the interactive narrative design by providing the interactors with greater autonomy and agency, particularly with more realistic choices that lead to lifelike and more meaningful consequences. It is also essential to enhance the observation of participants and control in future investigations. While online monitoring tools such as Zoom can be practical, conducting a similar study in a lab setting is recommended. Incorporating attention-check questions for engagement assessment may also mitigate the reliance on duration. Additionally, tailoring the text to the participant's native language is advisable as it could contribute to a different result. Further study should explore the potential role of moderators, such as dyslexia type, to better understand the relationship between information format and intrinsic motivation. Moreover, considering the potential biases associated with the use of ‘you,’ it is advisable to keep the characters and the pronouns constant between the textual narrative and the interactive narrative in future research.

Conclusion

The findings of this study offer partial support for the hypothesized mediation model, highlighting intrinsic motivation as a significant predictor of reading comprehension and a positive effect of textual narrative compared to expository text on reading comprehension. This contribution addresses a notable gap in the limited research on dyslexic adults, specifically regarding the influence of intrinsic motivation on reading comprehension. This study also

underscores that dyslexics' strengths, such as holistic thinking and strong visual imagery, could be leveraged by textual narrative to enhance intrinsic motivation for reading.

Furthermore, this study sheds light on the use of interactive narrative with limited agency may not be the best intervention for improving comprehension for dyslexic adults. Suggesting a need for further exploration into the role of agency and the potential variation in its degree in future research. While the findings imply the beneficial impact of intrinsic motivation on reading comprehension among dyslexic adults, a more comprehensive understanding of the intricate relationship between information format and comprehension requires further in-depth investigation.

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Appendix A

Information format – Content

Expository text

Long COVID is a disease where people who experience symptoms long after being infected with covid. It affects various fields in year life and comes with a range of symptoms. Everyone shows different symptoms. An example of a symptom is for instance (extreme) tiredness. Therefore, the patient needs a lot of rest. They can experience dizziness as well, making them feel as if they lose balance. Moreover, wordfinding problems occur often, meaning struggling to find the words to express yourself. Loss of smell is another symptom that may occur, as well as forgetfulness. Lastly, patients can experience heart palpitations, meaning your heart beats fast.

It is still unknown what the causes are of long COVID. There are some theories.

Here we will explain two of them. The first theory concerns an overactive immune system. The immune system, the defense system of our body, is confused. Immune cells in the body are mis programmed and may attack the body's own cells (autoimmunity). The body continues to fight the foreign invader, which has probably already left. It can reactivate underlying diseases, including infections (often harmless) experienced earlier in life.

The second theory concerns blood vessels. The virus can harm the walls of blood vessels, leading to inflammation in the small blood vessels. This inflammation can cause tiny clots called 'microclots' to block these small blood vessels. It results in poor blood flow, which means less transport of nutrients and oxygen. This can lead to damage to nerves and muscles.

There are multiple risk factors as to why some people are affected by long COVID and others are not. One of the risk factors is being a woman. Moreover, getting back to work too fast after being infected can put you at risk of getting long COVID as well. Furthermore, having an auto-immune disease can higher the risk as well. Lastly, having diabetes type-2 can be a risk factor as well.

Long COVID can have effect on different domains. It affects your personal life as well as your work life and the people surrounding you.

Textual narrative

"Alex's search for answers: Understanding long COVID"

I'm Alex, a 10-year-old boy with an important day ahead. Tomorrow, I have to give a presentation at school. My mom has long, and it inspired my choice of topic for my presentation: long COVID. You see, my mom has had long COVID for two years now. Poor mom, she is unable to work due to her illness.

Today, I am sitting down with my Mom, who has always been my superhero. She knows everything. She helped me prepare for my speech. She told me that long COVID is a disease

where people experience symptoms long after being infected with COVID. Mom began explaining that everyone experiences other symptoms. For her, long COVID made her feel tired all the time. I understood; Mom needed a lot of rest, and we couldn't play in the garden like we used to. She described another symptom, dizziness, which made it feel like her world was spinning. Mom pretended to wobble around the room, and it made me laugh, although I knew it wasn't really funny.

I asked, "Why do you have long COVID, Mom? My friend James' dad had COVID too, but he didn't get long COVID. What's happening to you?" Mom looked down and said, "I don't know, my dear. I wish I did." I felt confused; Mom always knew everything. We needed to solve this mystery!

We moved on to discussing the presentation, but Mom couldn't find the right words. Word-finding problems were a symptom as well. She often paused mid-sentence, searching for words, making her frustrated. Luckily, I was there to help her. "I know two symptoms!" I said. "Your loss of smell and forgetfulness," I remember coming home one day, and the house stank because you forgot you had a cake in the oven. Mom laughed "Haha you are right Alex! I forgot about the cake and could not smell the burned scents". We laugh about it now, but sometimes, I get mad at long COVID for taking away her smell and making her forgetful.

It was time for her to rest when she noticed heart palpitations. Her heart was racing. Mom placed my hand on her chest so I could feel it beat fast. It was a little scary, but I knew my mom was brave. Mom rested, turned on the television, and watched the news. "Alex! Come here!" she shouted. I rushed to her, asking, "What is it, Mom?" She said, "Look, they're talking about long COVID. You asked me today what's happening to me and why I got it? They just explained

it."She began explaining they don't know for sure yet what's happening inside her body, but there are two possible theories.

"One theory," she said, "is about our defender – the immune system. Once the COVID virus entered my body, the immune system started fighting the virus, and the COVID virus left. But my immune system got confused! It thinks the COVID virus is still in my body, so it keeps fighting although the virus has already left. It's like my immune system is overactive, trying to protect us from an invisible monster. It can even reactivate old illnesses such as (often harmless) infections experienced earlier in life."

"The other theory," she continued, "is about blood vessels. They are the tunnels inside our body, carrying nutrients and oxygen. Sometimes, the virus damages the walls of these tunnels, especially the small ones. When the walls of these tunnels are damaged by the virus, it creates inflammation. This inflammation creates tiny clots called 'microclots' that block the tunnels. When that happens, the nutrients and oxygen stuff can't get through. This can hurt our nerves and muscles."

I asked, "And did they tell you why you got it?". Mom replied, "That's still a bit of a mystery, my dear, but some things put me at higher risk. I'm a woman, I have diabetes type 2, and I have an auto-immune disease. Plus, I returned to work very fast after being infected. It's better to take more rest."

The next day, my presentation was scheduled. I was a little nervous but well-prepared. I talked about my mom, her symptoms like a racing heart and forgetfulness, and what's possibly happening inside her body: the overactive immune system and the inflammation in her blood vessels. I also discussed the risk factors, such as being a woman and returning to work too quickly. I was super proud of how it went, and so was my mom!

Interactive Narrative

"Alex's search for answers: Understanding long COVID"

Alex: Hi! I'm Alex, I'm 10 years old.

Decision Point 1:

A: Hi too Alex! B: Hello?

Alex: Would you mind coming along with my day today?

I have an important day ahead.

Decision Point 2:

A: Sure! B: Nope

Alex: Oh please!

I promise you I'm a smart kid!

Decision Point 3:

You: Okay

Part 1

Alex: Hey! You know why tomorrow is a really important day?

I have to give a presentation at school!

But lately something has been off …

My mom has long COVID for two years already

Decision Point 4:

A: Oh, I'm so sorry to hear that B: what is that?

Alex seems to be thinking....

Alex: But that's it! That's my topic for the presentation tomorrow! It should be Long COVID!

Alex: You see, my mom is like my superhero. She knows everything. She will help me prepare for my speech! I have to find my Mom!

Alex: Mom??? Where are you?

Mom: Here! In the living room!

Come sit with me!

Alex sat down at the table, near Mom.

Alex: Mom! I want to make a presentation tomorrow about your long – COVID!

Mom: Oh Great! How can I help you?

Decision Point 5:

Should Alex ask …

A: About her symptoms? B: What caused her long COVID?

Option A answer:

Oh, Alex, everyone experiences other symptoms, but my long COVID made me feel tired all the time. It also makes me dizzy, that world spins.

But you know, what's funny, that we still don't know what caused all of this!

I think a detective like you is up to the task of solving this mystery!

Option B answer:

Oh Alex, I wish I knew, but no one knows what caused all of this!

I think a detective like you is up to the task of solving this mystery!

But do you know what is more important?

What are the symptoms!

Everyone experiences all kinds of symptoms, but my long COVID made me feel tired all the time. It also makes me dizzy, that the world spins.

Part 2

Alex: Oh wow, that is a lot, my poor mom...

Alex: But, at school my buddy James, his dad also had COVID.

But he didn't get long covid? How come?

Decision point 6:

Should Alex ask her …

A: Why is this happening to you? B: Insist to ask James's Dad

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Option A answer:

I don't know my dear, I wish I did...

nobody knows yet what caused it

But let's focus back on you! And your presentation!

Option B answer:

Why... I don’t think he will have answer for us either Alex.

Since nobody knows yet what caused it, I wish I did...

But let’s focus back on you! And your presentation!

Part 3

Alex and Mom move on into Alex’s presentation again...

But it seems like Mom is having a hard time...

Alex: What is it, Mom? You look like you are thinking hard.

Mom: I am, dear. I'm trying to think what my other symptoms are...

(pause) what is it... (Long pause) ...

Aha! Of course, trouble finding words!

Alex: (giggling) That happens to me all the time! Don’t worry mom! It's like my brain is playing tricks on me.

Mom: It's just...um...(pause) how to put it...

Alex: Don’t worry mom, I’m here to help you. So, what are you trying to say?

Mom: Thankyou dear. Well, I'm trying to describe how I'm feeling right now. But I can't find the right word.

Should Alex ask...

Decision point 7:

A: Are you feeling Sad? B: Are you feeling Angry?

Mom: No, not that …

Decision point 8:

Should Alex ask...

A: Frustrated? B: Confused?

Option A answer:

Mom: Yes! That's it! I'm feeling frustrated.

Option B answer:

Mom: Close, but not it...

Decision point 9:

You: Frustrated?

Mom: Yes! That's it! I'm feeling frustrated.

Alex: ah! glad we figured it out! I must say this symptom is way better than your loss of smell I think that's your weirdest symptom!

Mom: Oh Alex, do you still remember that day?

Alex: Well, yes! our house stank!

Because you left the cake in the oven!

Mom: Ha-ha you are right Alex, I could not smell the burnt cake scents

(Laugh together)

Alex: I’m glad that even though long COVID is taking away her smell and making her forgetful we can still have a good time, but sometimes I wish it has not happened to mom...

Part 4

Mom: Oh... I think it’s time for me to rest...

Alex: What is it mom?

Mom: I noticed my heart races so fast! It's my heart palpitations.

She put Alex hand in her chest.

Mom: Here, can you feel the beat?

Alex: Woah, it raced like a race car. It’s scary mom, are you okay?

Mom: You know I’m a brave woman, I’m fine! And you should not worry, rather than worrying, let’s watch the TV together, shall we?

She turns on the TV and put on the News.

Mom: Look, they're talking about long COVID on the TV. This is what I've been trying to tell you all day.

Alex: Oh, cool. Let's hear it!

Mom and Alex watch the news report together.

Mom: Okay, so doctors still don’t know for sure just yet what causes the long COVID. But there are two possible theories that could explain it! One is about blood vessels and the other is about immune system.

Should Alex ask...

Decision point 10:

A: Tell me about the blood vessels! B: Tell me about the immune system!

Option A answer:

Mom: Okay. One theory is that it's caused by damage to the blood vessels. You know, those little tubes that carry blood around our bodies?

Alex: Yeah.

Mom: Well, the virus can damage these blood vessels, causing inflammation.

When it happens it can create tiny clots called "microclots" that block the blood vessels. When that happens, the blood can't flow through the vessels properly, and that can hurt our nerves and muscles.

Alex: Interesting, now I want to know too what's the other theory?

Mom: Ha-ha, okay, the other one is that long- COVID is caused by our immune system. Instead of fighting the virus, it attacks our own body.

Alex: Why would our immune system do that?

Mom: Well, they think it might be because our immune system is confused. They can’t tell who the bad virus or good cells of our body and it is starting to attack our own bodies.

Alex: That's weird.

Mom: It is, and because of that, it might reactivate our old illnesses.

Option B answer:

Mom: One theory is that long COVID is caused by our immune system.

Instead of fighting the virus, it attacks our own body.

Alex: Why would our immune system do that?

Mom: Well, they think it might be because our immune system is confused. They can't tell who the bad virus or good cells of our body and it is starting to attack our own bodies.

Alex: That's weird.

Mom: It is, and because of that, it might reactivate our old illnesses.

Alex: Interesting, now I want to know too what's the other theory?

Mom: Okay. The other theory is that it's caused by damage to the blood vessels. You know, those little tubes that carry blood around our bodies?

Alex: Yeah.

Mom: Well, the virus can damage these blood vessels, causing inflammation.

When it happens it can create tiny clots called "microclots" that block the blood vessels. When that happens, the blood can't flow through the vessels properly, and that can hurt our nerves and muscles.

Part 5

But something still doesn't sit right with Alex...

Alex: But Mom, Did the TV tell you why you got long COVID and not other people?

Mom: That's still a bit of a mystery, my dear. But some things put me at higher risk. I'm a woman, I have type 2 diabetes, and I have an autoimmune disease. Plus, I returned to work very fast after being infected. It's better to take more rest.

Alex: I'm sorry, Mom. I didn't realize that you were at higher risk.

Mom: It's okay, dear, I hope this clears up for your presentation!

Alex: It sure did

The Next day

Alex: Hey, thank you for your help!

I was a little nervous this morning, but I was well prepared! I talked about my mom, her symptoms like a racing heart and forgetfulness.

And what's possibly happening inside her body, the "microclot" and immune system.

I also discussed the risk factors, such as being a woman and returning to work too quickly. I was super proud, and so was my mom! I hope you are too!

Alex: Thanks for coming along with my day!

The End

Appendix B

Pre-test

Pre-test to check participant's general knowledge on long COVID.

Informed consent

Dear Participant,

Thank you for taking the time to participate in this pre-test survey. Please read the information below carefully before you continue.

Our pre-test aims to investigate the current knowledge about post-covid syndrome, also known as long covid. Your participation is entirely voluntary. You are not required to provide any specific responses, and you may withdraw from the survey at any time without facing any consequences. The questionnaire will take approximately 3 minutes to complete, and your answers will be kept anonymous. Your data will be treated with the most confidentiality and will only be accessible to the teaching staff of the Tilburg University's department of Humanities and Digital Sciences and the research students involved in this pre-test.

By participating in this survey, you may benefit from the knowledge provided about the post-covid syndrome. Please note that there are no right or wrong answers as we are assessing the general knowledge of the post-covid syndrome. If you have any questions about this research project, feel free to contact Eefje van Moorsel, e.a.m.vanmoorsel@tilburguniversity.edu.

Informed Consent:

I have had the opportunity to read this consent form and understood the information provided in this consent form, and I agree to participate in the pre-test as outlined above.

If you agree to participate in this survey, please select "Yes, I agree to participate" on the button below.

By clicking the button below, you acknowledge:

Your participation in the pre-test is voluntary.

You are 18 years of age.

You are aware that you may choose to terminate your participation at any time for any reason.

Pre-test questionnaire

1: Are you familiar with the term post-covid syndrome (also known as ‘long COVID’)?

- Yes
- No

2: Is there anyone you know who experiences/has experienced post-covid syndrome?

- Yes
- No

3.Do/did you experience post-covid syndrome yourself?

- Yes
- No

4: Which physical symptoms do people with the post-covid syndrome experience?

Open answer

5: Do people with post-covid syndrome experience mental problems as consequence of their disease?

- Yes, they do
- No, they don’t à skip question 6
- I don’t know à skip question 6

6: If you think so, which ones would that be?

Open answer

7. Which of the following factors do you think will increase the likelihood of someone developing post-covid syndrome? Multiple answers are correct

- Being a women
- Being a man (F)
- People with autoimmune diseases
- People with a history of Epstein-Barr virus (EBV) infection
- People with Q fever
- People with ADHD
- People with Dyslexia (F)
- People who are below the age of 10 and over the age of 70 years old (F)
- People with type 2 diabetes
- People with chronic urticaria (hives)
- People with Alzheimer's disease (F)
- People with connective tissue disorders such as rheumatoid arthritis
- People with a history of migraines (F)

- People with allergic rhinitis (chronic inflammation of the nasal lining)
- People of Spanish or Latino descent
- People who return to work too soon after a COVID-19 infection
- People who are fully vaccinated (F)

8: Do you know any hypotheses about the possible causes of post-covid syndrome?

- Yes
- No --> skip question 9

9: Which theory do you know?

Open answer

10: Does post-covid syndrome follow a linear path in recovering?

- Yes, the recovery follows a steady and predictable course, with symptoms steadily disappearing without significant setbacks.
- No, the recovery is inconsistent and unpredictable, with symptoms fluctuating and varying over time including regular setbacks.
- I don’t know

11. Which of the symptoms listed do you believe are associated with post-COVID syndrome?

- Fatigue
- Concentration problems
- Condition loss

- Memory loss/forgetfulness
- Wordfinding problems
- Oversensitivity for light and sounds
- Shortness of breath during exertion
- Depressive feelings
- Headache
- Gloominess/irritability
- Sleeping problems
- Muscle weakness
- Sore muscles
- Dizziness
- Confusion
- Shortness of breath during rest
- Pressure on the chest
- Anxiety
- Tinnitus
- Heart palpitations
- Variations in temperature
- Joint pain
- Vision problems
- Abdominal complaints
- (Night) sweating

- Less or no sense of smell
- Less or no sense of taste
- Coughing
- Skin problems
- Sore throat
- Recurring infections
- Hair loss
- Decreased appetite

Debriefing

Thank you again for your participation in our pre-test. We aimed to examine the knowledge of the post-covid syndrome. All information is derived from C-support. Please note that the question '*Which of the following factors do you think will increase the likelihood of someone developing post-covid syndrome? Multiple answers are correct*' contained some false answers, which were: 1. Being a man 2. People who are below the age of 10 and over the age of 70 years old 3. People with a history of migraines 4. People who are fully vaccinated. 5. People with Alzheimer's disease 6. People with dyslexia. If you have any questions about the pre-test, please feel free to contact Eefje van Moorsel, e.a.m.vanmoorsel@tilburguniversity.edu.

Appendix C

Reading Comprehension Test

It is time for the test. In this section, you will be asked some questions about long COVID based on the text you just read. Please read these questions carefully. The answers cannot be edited once you move to the next page. Only one answer is correct.

1. According to the text, what is long COVID?

- A condition that occurs during the COVID-19 infection
- **A condition where people experience symptoms long after being infected with COVID-19**
- A condition where people experience lung-related symptoms after being infected with COVID-19
- A state of prolonged contagiousness after recovering from COVID-19

2. According to the text, what is one of the common symptoms of long COVID?

- **Forgetfulness**
- Nausea
- Joint paint
- Rashes

3. What is a known cause of long COVID, according to the text?

- A genetic problem
- Low blood pressure
- Inactive immune system
- **There is no known cause yet.**

4. What does the text say about the possible cause of long COVID related to the immune system? The immune system….

- becomes slow, leading to increased vulnerability to outside infections.
- is ineffective in responding to infections.
- **is overactive.**
- heightens the response to pollen, leading to hay fever.

5. According to the text, what happens to the walls of blood vessels in the theory of causes of long COVID? These walls become…

- **Inflamed**
- Swollen
- Smaller
- Unaffected

6. What is a risk factor for long COVID as mentioned in the text?

- Diabetes type I
- Being a man
- **Having an autoimmune disease**
- History of infections

7. Which statement below is true:

1. Long COVID symptoms' primary cause is well-established.

2. Overworking after being infected with COVID increases the risk of developing long COVID.

- Statement 1 is true, statement 2 is false
- **Statement 1 is false, statement 2 is true**
- Both are false
- Both are true

8. Which statement below is true:

The text mentioned...

1. word finding problems are rare in long COVID patients.

2. chest pain as one of the symptoms

- Statement 1 is true, statement 2 is false
- Statement 1 is false, statement 2 is true
- **Both are false**
- Both are true

9. From the information provided about the theories concerning the causes of long COVID, what can be said about the potential impact of long COVID on the immune system?

- The disrupted immune system in long COVID patients might not reactivate any underlying diseases.
- Long COVID causes the immune system to function more effectively against the virus even after it has left the body.

- **The disrupted immune system in long COVID patients can potentially reactivate old diseases, complicating the condition further.**
- Long COVID patients' immune systems remain unaffected by the virus post-recovery.

10. Based on your understanding of the text, which statement below is true?

1. The unknown cause makes it challenging to determine appropriate treatments for long COVID.
2. Long COVID treatment is exclusively reliant on antiviral medication.

- **Statement 1 is true, statement 2 is false**
- Statement 1 is false, statement 1 is true
- Both are false
- Both are true

Appendix D

Intrinsic Motivation Scale (IMI)

Likert Scale 1-7, 1: strongly disagree to 7: strongly agree

Interest / Enjoyment

1. While I was reading this material, I was thinking about how much I enjoyed it.
2. This text holds my attention.
3. This material was fun to read.

Perceived competence

1. I think I understood this material pretty well.
2. I think I understood this material very well compared to other students.

Perceived autonomy

3. While doing this activity I felt like I had a choice

Appendix E

Manipulation Check

Please indicate below to which extent you agree with the following statement about the text.

Please do this honestly. There are no right or wrong answers.

Perceived Narrativity

The information was provided in a story format

- Yes
- No

Perceived Agency/Effectance

(Likert Scale 1-7, 1: strongly disagree - 7: strongly agree)

1. I had the feeling that I could directly affect something in the tex.

Appendix F

English Proficiency Test Questionnaire

Please select the category that best describes your level of English reading:

- Basic
- Intermediate
- Fluent

Long COVID Familiarity Questionnaire

1. Do you know what the post-covid syndrome is? (Also known as long covid)
   a. Yes

b. No

2. Do/did you experience post-covid syndrome yourself?

a. Yes

b. No

3. Does/did someone who is close to you experience post-covid syndrome?

a. Yes

b. No

4. Have you ever investigated what post-covid syndrome is?

a. Yes

b. No

Appendix G

Full survey

Information letter and informed consent

Dear Respondent,

- This study is part of our Master's program in Communication and Information Sciences at Tilburg University.
- Its purpose is to investigate how the strengths of individuals with dyslexia can be better utilized.
- During this study, a text will be provided, and afterward, you will be asked to take a test based on the given text. The results of this test will have no impact on your professional career or your studies and will only be used for research purposes. To ensure the validity of the research, the specific purpose and form of the study cannot be disclosed in advance.

For this research, it is essential that you have been diagnosed with dyslexia by a professional and are at least 18 years old.

- The study will take approximately 20 minutes and has been approved by the Ethics Committee of the Tilburg School of Humanities and Digital Sciences. There are no physical or mental risks associated with the study. However, the subject of the text you will be presented with is 'long COVID.' Personal experiences or experiences of people in your surroundings with long COVID may evoke unpleasant feelings or memories during the study. If this happens, please feel free to discontinue the study immediately with no consequences. You can also seek information or support from C-support (www.c-support.nu), an organization specializing in supporting individuals with long-lasting COVID symptoms.
- For any complaints, you can contact the Ethics Committee of the Tilburg School of Humanities and Digital Sciences at tshd.redc@tilburguniversity.edu. We request information about your gender, age, level of education, English proficiency, and general knowledge of long COVID. We collect this data to describe the characteristics of our participant group and identify general patterns.
- Outside of this research, we will not use your personal information. We treat your data confidentially, and your personal information is not directly linked to you. We do not store your email address. Your data will be retained for a maximum of 10 years unless you object at a later time. During these 10 years, the data will only be shared with other researchers with permission of the main applicant; this sharing will take place in a safe environment in which the data will be encrypted. Your participation is entirely voluntary, and you can end your participation in the survey at any time, for any reason, by closing the

survey. Participants through the Human Subject Pool will receive 0.5 credits for their participation in this study.

- If you have any questions, please feel free to send an email to one of the researchers: Eefje van Moorsel (e.a.m.vanmoorsel@tilburguniversity.edu) or Judith Novia Tanta (JudithNoviaTanta@tilburguniversity.edu).

Informed Consent:

By clicking the "Yes, I agree to participate" button, you give your consent to participate in this research. You acknowledge that:

You have read the information above and had the opportunity to ask questions about the study beforehand.

You also acknowledge that you have been formally diagnosed with dyslexia by a professional and are at least 18 years old.

You recognize that your participation in this study is voluntary and that you can terminate it at any time, without any consequences and without the need to provide a reason.

You consent to the collection of the mentioned demographic data, which will be processed and treated in a completely anonymous and confidential manner.

You consent to the storage of research data for a period of ten years.

You consent to letting the main applicant decide if the data can be shared with other researchers.

Thank you in advance,

Eefje van Moorsel (e.a.m.vanmoorsel@tilburguniversity.edu)

Judith Novia Tanta (JudithNoviaTanta@tilburguniversity.edu)

If you do not agree, please close this window.

- Yes I agree to participate

Pre-liminary questions

Thank you for participating.

- Let's begin with some questions about you:

Q1 What is your age?

- Under 18 years old
- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65-74 years old
- 75 years and older

Q2 Have you ever received a formal diagnosis of dyslexia from a qualified healthcare professional?

- Yes
- No

Demographic questions

Q3 What is your gender?

- Male
- Female
- Non-binary-third gender

- Other:
- Prefer not say

Q4 What is the highest level of education you have completed?

If you do not reside in the Netherlands, you can disregard the information within the brackets.

- No formal education
- High school diploma (VMBO, HAVO, VWO)
- Vocational training (MBO)
- Bachelor's degree (HBO/WO)
- Master's degree (HBO/WO)
- Doctorate degree

Q5 Please select the category that best describes your level of English reading:

- Basic
- Intermediate
- Fluent

Pre-test familiarity long COVID

Q6 Are you familiar with the term long COVID?

- Yes
- No

Q7 Do/did you experience long COVID yourself?

- Yes
- No

Q8 Does/did someone who is close to you experience long COVID?

- Yes

- No

Q9 Have you ever investigated what long COVID is?

- Yes
- No

Pre-test test anxiety

Q10 Now, we would like to know to what extent you feel anxious when you are about to take a test.

Please indicate below to which extent you agree with the following statements about yourself. Please do this honestly, there are no right or wrong answers.

a. When I take a test I think about how poorly I am doing compared with other students.

b. When I take a test I think about items on other parts of the test I can't answer.

c. When I take tests I think of the consequences of failing.

d. I have an uneasy, upset feeling when I take an exam.

e. I feel my heart beating fast when I take an exam.

Answer options: 1. Strongly disagree, 2. Disagree, 3. Somewhat disagree, 4. Neither agree nor disagree, 5. Somewhat agree, 6. Agree 7. Strongly agree

(Stimuli)

Self-efficacy

Q11 As mentioned before, you are about to take a test about the just provided information. Now, you are presented with some statements regarding your beliefs to successfully take this test. **The statements below refer to this upcoming test.**

Please indicate below to which extent you agree with the following statements about yourself. Please do this honestly. There are no right or wrong answers.

a. I Believe I will receive an excellent grade in this test
b. I’m certain I can understand the most difficult material presented in the reading
c. I’m confident I can understand the basic concepts that were taught in this text
d. I'm confident I can do an excellent job on the test
e. I expect to do well in this test
f. I'm certain I can master the knowledge that was taught in this text
g. Considering the difficulty of this text, and my skills, I think I will do well in this test

Answer options: 1. Strongly disagree, 2. Disagree, 3. Somewhat disagree, 4. Neither agree nor disagree, 5. Somewhat agree, 6. Agree 7. Strongly agree

Post-test test anxiety

Q12 Now you are presented with some statements regarding your test anxiety level again. As mentioned before, you will take a test about the just provided information later on. **The statements below refer to this upcoming test.**

- Please indicate below to which extent you agree with the following statements about yourself. Please do this honestly. There are no right or wrong answers.

a. Now I have to take this test, I think about how poorly I will do compared with other students.

b. When I take this test, I will think about items on other parts of the test I can't answer.

c. When I take this test, I think of the consequences of failing.

d. I have an uneasy, upset feeling now I have to take this test.

e. I feel my heart beating fast now I will take this exam.

Answer options: 1. Strongly disagree, 2. Disagree, 3. Somewhat disagree, 4. Neither agree nor disagree, 5. Somewhat agree, 6. Agree 7. Strongly agree

Reading comprehension

It is time for the test. In this section, you will be asked some questions about long COVID based on the text you just read.

Please read these questions carefully. The answers cannot be edited once you move to the next page. Only one answer is correct.

Q 13 According to the text, what is long COVID?

- A condition that occurs during the COVID-19 infection
- **A condition where people experience symptoms long after being infected with COVID-19**
- A condition where people experience lung-related symptoms after being infected with COVID-19
- A state of prolonged contagiousness after recovering from COVID-19

Q14 According to the text, what is one of the common symptoms of long COVID?

- **Forgetfulness**
- Nausea
- Joint pain
- Rashes

Q15 What is a known cause of long COVID according to the text?

- A genetic problem
- Low blood pressure
- Inactive immune system
- **There is no known cause yet**

Q16 What does the text say about the possible cause of long COVID related to the immune system? The immune system….

- Becomes slow, leading to increased vulnerability to outside infections

- Is ineffective in responding to infections
- **Is overactive**
- Heightens the response to pollen leading to hay fever

Q17 According to the text, what happens to the walls of blood vessels in the theory of causes of long COVID? These walls become…

- **Inflamed**
- Swollen
- Smaller
- Unaffected

Q18 What are some risk factors for long COVID as mentioned in the text?

- Diabetes type I
- Being a man
- **Having an autoimmune disease**
- History of infections

Q19 Which statement below is true:

I. Long COVID symptoms primary cause is well-established

II. Overworking after being infected with COVID increases the risk of developing long COVID.

- Statement 1 is true, statement 2 is false
- **Statement 1 is false, statement 2 is true**
- Both are false

- Both are true

Q20 Which statement below is true:

The text mentioned...

1. word finding problems are rare in long COVID patients.

2. chest pain as one of the symptoms

- Statement 1 is true, statement 2 is false
- Statement 1 is false, statement 2 is true
- **Both are false**
- Both are true

Q21 From the information provided about the theories concerning the causes of long COVID, what can be said about the potential impact of long COVID on the immune system?

- The disrupted immune system in Long COVID patients might not reactivate any underlying diseases.
- Long COVID causes the immune system to function more effectively against the virus even after it has left the body.
- **The disrupted immune system in long COVID patients can potentially reactivate old diseases, complicating the condition further.**
- Long COVID patients' immune systems remain unaffected by the virus post-recovery.

Q22 Based on your understanding of the text, which statement below is true?

1. The unknown cause makes it challenging to determine appropriate treatments for long COVID.

2. Long COVID treatment is exclusively reliant on antiviral medication.

- **Statement 1 is true, statement 2 is false**
- Statement 1 is false, statement 2 is true
- Both are false
- Both are true

Narrative reasoning

Now you are presented with some statements regarding your preferences in information processing.

Please indicate below to which extent you agree with the following statements about the text. Please do this honestly. There are no right or wrong answers.

a. When I am trying to learn a new concept, I prefer my instructor to start with a story, case, or example, rather than to start with a precise definition.

b. I typically reason, remember, and learn better using stories, cases, or examples, rather than abstract concepts or definitions.

c. I often need to memorize rote information (naked facts or lists), like making up a story, song or rhyme about them.

d. If someone asked me to think about an abstract term like justice, I'd usually think first about stories or images or examples of behaviour, rather than abstract definitions of justice.

e. When I think of historical events, I see scenes in my mind rather than just verbal descriptions.

Answer options: 1. Strongly disagree, 2. Disagree, 3. Somewhat disagree, 4. Neither agree nor disagree, 5. Somewhat agree, 6. Agree 7. Strongly agree

Manipulation check

The following questions are about your view on the narrativity of the text.

Q22: Was the information provided in a story format?

- Yes
- No

Q23 Was the information provided using a visual story?

- Yes
- No

Q24 Please indicate below to which extent you agree with the following statement about the text. Please do this honestly. There are no right or wrong answers.

I had the feeling that I could directly affect something in the text.

Appendix H

Table 4

Descriptive Information & Normality Check: Skewness and Kurtosis Z-Scores

	Mean	Std. Deviation	Skewness	Std.Error of Skewness	Kurtosis	Std. Error of Kurtosis	z-skewness	z-kurtosis	Assumption met?
Age	2.57	0.58	0.39	0.34	-0.73	0.67	1.14	-1.10	Yes
Gender	1.47	0.54	0.53	0.34	-0.92	0.67	1.56	-1.37	Yes
Education Level	3.29	1.04	-0.15	0.34	-1.45	0.67	-0.44	-2.17	No
English Proficiency	2.16	0.69	-0.22	0.34	-0.82	0.67	-0.65	-1.23	Yes
English Proficiency (Excluding 'Basic')	2.39	0.24	0.47	0.37	-1.88	0.72	1.27	-2.59	No
Familiarity with Covid	1.55	0.89	-0.29	0.34	0.17	0.67	-0.86	0.25	Yes
Perceived Narrativity (Mean)	3.33	1.57	0.16	0.39	-0.88	0.77	0.41	-1.15	Yes
Perceived Agency	3.54	1.44	-0.10	0.29	-0.90	0.57	-0.36	-1.60	Yes
Intrinsic Motivation (Mean)	3.86	1.12	-0.80	0.34	0.18	0.67	-2.35	0.28	No
Reading Comprehension (Sum of Correct Scores)	6.98	2.03	-0.33	0.34	-0.40	0.67	-0.98	-0.59	Yes

Note: The normality assumption was assessed based on skewness and kurtosis z-scores. A z-score outside the range of -1.96 and +1.96

indicates a violation of the assumption. To ensure normality for subsequent hypothesis testing, the 'Basic' category was excluded from the English Proficiency variable, rendering the variable Kurtic. After this adjustment, all other variables in the analysis met the normality assumption criteria; Intrinsic Motivation remained skewed, and 'Education level' retained kurtosis. Therefore, only the results for English Proficiency (Excluding the 'Basic' category) are presented in this table.

Table 5

Homogeneity Check: Variance Score

Variable	Condition	Variance	High/Low	Homogeneity Violated?
Age	Expository Text	0.35	1.45	No
	Textual narrative	0.26		
	Interactive Narrative	0.37		
Gender	Expository Text	0.26	1.75	No
	Textual narrative	0.22		
	Interactive Narrative	0.38		
Education Level	Expository Text	1.11	1.68	No
	Textual narrative	0.76		
	Interactive Narrative	1.28		
English Proficiency	Expository Text	0.45	1.37	No
	Textual narrative	0.62		

	Interactive Narrative	0.46		
Familiarity with Covid	Expository Text	0.06	0.06	No
	Textual narrative	0.07		
	Interactive Narrative	0.06		
Intrinsic Motivation (Mean)	Expository Text	1.67	0.63	No
	Textual narrative	1.25		
	Interactive Narrative	0.63		
Reading Comprehension (Sum of correct score)	Expository Text	3.54	4.96	No
	Textual narrative	2.02		
	Interactive Narrative	4.96		

Note. The homogeneity assumption depends on the criterion that the degrees of freedom (Df) exceed 30, and the ratio of maximum variance to minimum variance falls out of the range of 2-3

Table 3

Below are the new VR values if 'Basic' from EN_Proficiency is removed.

	Condition	**Variance**	**High/Low**	**Homogeneity Violated?**
Age	Expository Text	0.571	2.05	No
	Textual narrative	0.278		
	Interactive Narrative	0.401		
Gender	Expository Text	0.286	2.16	No
	Textual narrative	0.194		
	Interactive Narrative	0.418		
Education Level	Expository Text	1.143	1.74	No
	Textual narrative	0.75		
	Interactive Narrative	1.302		
English Proficiency	Expository Text	0.286	1.16	No
	Textual narrative	0.278		
	Interactive Narrative	0.247		
Familiarity with Covid	Expository Text	0.03	2.3	No
	Textual narrative	0.069		
	Interactive Narrative	0.048		
Perceived Narrativity	Expository Text	1.417	2.64	No
	Textual narrative	1.194		
	Interactive Narrative	3.148		

Perceived Agency	Expository Text	0.905	4.37	Yes
	Textual narrative	1.528		
	Interactive Narrative	3.956		
Intrinsic Motivation (Mean)	Expository Text	0.658	1.08	No
	Textual narrative	0.713		
	Interactive Narrative	0.659		
Reading Comprehension (Sum of Correct Scores)	Expository Text	1.619	3.69	Yes
	Textual narrative	1.778		
	Interactive Narrative	5.962		

Appendix I

Correlation Analysis

Descriptive

	Mean	Std. Deviation	N
Sum right answers	6.4429	2.32588	70
Mean_Familiarity	.4714	.24651	70
English Proficiency Level	2.0714	.68781	70

Correlations

		Sum right answers	Mean_Familiarity	English Proficiency Level
Pearson Correlation	Sum right answers	1.000	-.104	.369
	Mean_Familiarity	-.104	1.000	**.034**
	English Proficiency Level	.369	.034	1.000
Sig. (1-tailed)	Sum right answers	.	.196	.001
	Mean_Familiarity	.196	.	.391
	English Proficiency Level	.001	.391	.
N	Sum right answers	70	70	70
	Mean_Familiarity	70	70	70
	English Proficiency Level	70	70	70

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	English Proficiency Level, Mean_Familiarity[b]	.	Enter

a. Dependent Variable: Sum right answers

b. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics	
					R Square Change	F Change
1	.387[a]	.150	.125	2.17602	.150	5.916

Model Summary[b]

Model	Change Statistics		
	df1	df2	Sig. F Change
1	2	67	.004

a. Predictors: (Constant), English Proficiency Level, Mean_Familiarity

b. Dependent Variable: Sum right answers

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	56.024	2	28.012	5.916	.004[b]
	Residual	317.248	67	4.735		
	Total	373.271	69			

a. Dependent Variable: Sum right answers

b. Predictors: (Constant), English Proficiency Level, Mean_Familiarity

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t
		B	Std. Error	Beta	
1	(Constant)	4.346	.957		4.542
	Mean_Familiarity	-1.100	1.063	-.117	-1.034
	English Proficiency Level	1.263	.381	.373	3.313

Coefficients[a]

Model		Sig.	95.0% Confidence Interval for B	
			Lower Bound	Upper Bound
1	(Constant)	.000	2.436	6.255
	Mean_Familiarity	.305	-3.222	1.023
	English Proficiency Level	.001	.502	2.023

a. Dependent Variable: Sum right answers

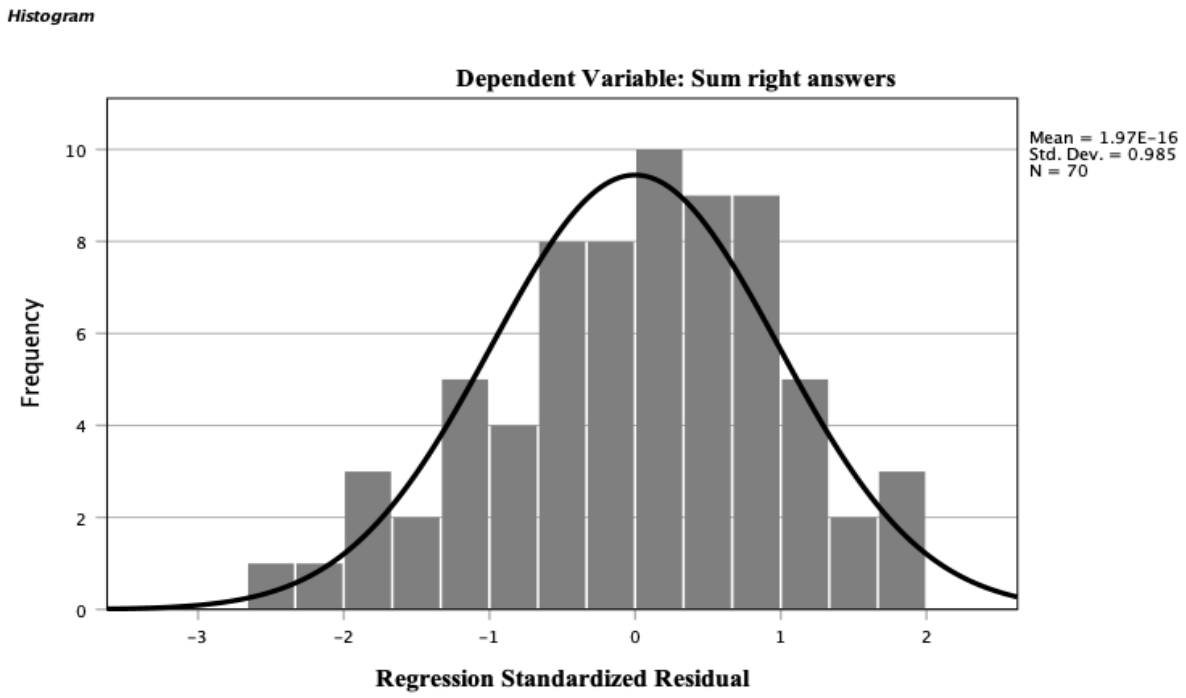
Residuals Statistics[a]

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	4.5088	8.1337	6.4429	.90107	70
Residual	-5.59614	3.67875	.00000	2.14425	70
Std. Predicted Value	-2.146	1.876	.000	1.000	70

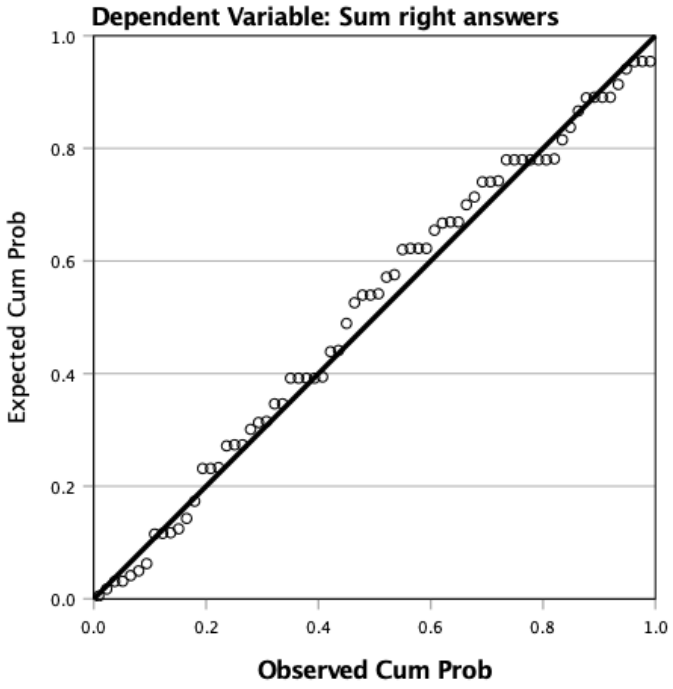
Std. Residual	-2.572	1.691	.000	.985	70

a. Dependent Variable: Sum right answers

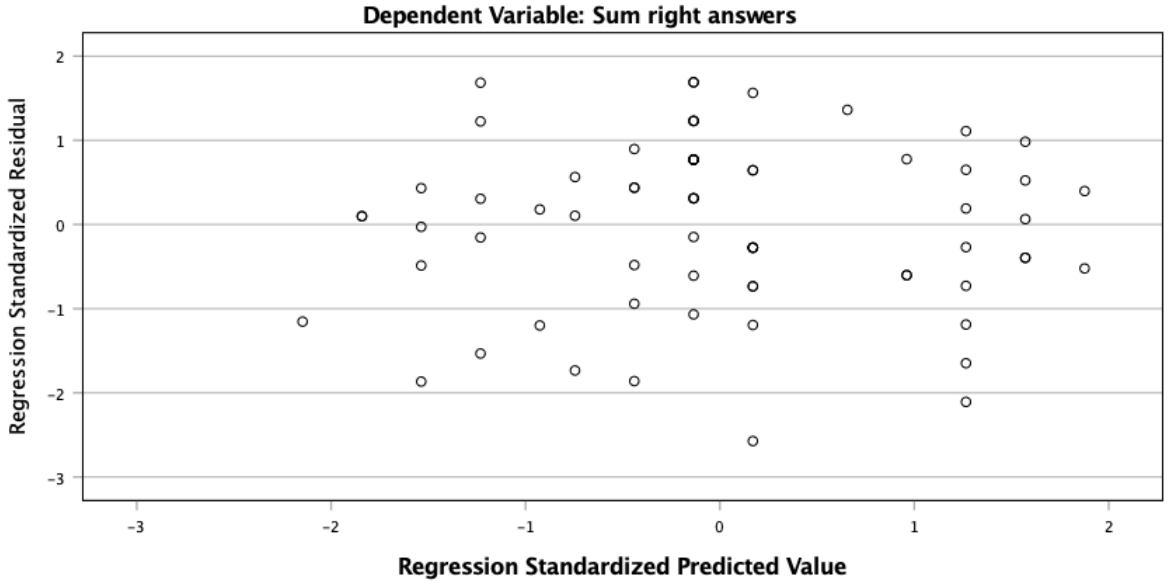
Charts



Normal P-P Plot of Regression Standardized Residual



Scatterplot



Appendix J

Breakdown of the Exploratory Analysis

The data was kurtic (see Appendix H), necessitating reliance on bootstrap confidence intervals.

Abbreviations: Expository text (ET), textual narrative (TN), interactive narrative (IN), Reading Comprehension (RC), IM (intrinsic motivation)

1.1 Initial Hypothesis results

H1= RC is predicted to be the highest on IN > NT> ET.

This hypothesis is **partially supported.**

Result: **sig. total effect** of F (2, 46) = 3.39, *p* = 0.04, R-sq = 0.13.

RC is the highest at NT > ET > IN (M: 8.27, 6.8, 6.4, respectively)

Pairwise comparison:

ET vs TN (*b* =1.47, BCa 95% CI = [0.01, 2.93] , **significant difference**

ET vs IN (b = -0.41, t(48) = -0.66, p = 0.52, BCa 95% CI = [-1.67 , 0.85]). Non-significant

TN vs IN (*M*= 6.39, *b* =-1.88, *SE*=…, BCa 95% CI = [-3.37, -0.40]) **significant difference**

1.2 With English proficiency (All)

H1= F (3, 45) = 3.28, p = 0.03, R-sq = 0.18 CI ; **sig total effect.**

NT (M= 6.76) > ET (M=5.37) > IN (M=4.98). **Same hierarchy as initial hypothesis**

ET vs NT = b = 1.39 BCa 95% CI = [-0.05, 2.83] Non-significant

ET vs IN= b = -0.39, BCa 95% CI = [-1.63, 0.86]. Non-significant

NT vs IN b = -1.78, BCa 95% CI = [-3.24, -0.31]. **significant difference**

1.3 EN without basic

H1 **= no total effect**

NT (M = 6.65) > ET(M = 7.80) > IN (M = 5.82). **Same hierarchy as the initial hypothesis**

ET vs NT (, b = 6.65, t(48) = 4.31, BCa 95% CI = [0.83, 7.33]) **significant difference**

ET vs IN b = -0.83, t(48) = -1.22, p = 0.23, Bootstrapped CI = [-2.47, 0.28]). Not sig

NT vs IN = -1.99, t(48) = -2.42, p = 0.02, Bootstrapped CI = [-3.25, -0.26]. **significant difference**

2.1 Initial Hypothesis Result

H2 = IM is the highest in IN > NT > ET.

H2 is not supported, no significant result.

NT > IN > ET (M= 4.18, 4.083, 3.47)

ET vs TN (b = 0.70, BCa 95% CI = [-0.12 ,1.53] not significant

ET vs IN (b = 0.61, t(48) = 1.71, BCa 95% CI = [-0.11 ,1.32]) not significant

TN vs IN (b = -0.09, BCa 95% CI = [-0.94, 0.75] not significant

2.2. With English proficiency (All)

H2 = F (3,45) = 2.97, p = 0.04, R-sq =0.17. **significant result, H2 becomes supported. (contrary to initial)**

IM the highest = NT (M= 3.12) > IN (M= 3.10) > ET (M = 2.47)

ET vs NT b = 0.65, t (48) = 1.63, p = 0.11, CI = [-0.15,1.45] not significant

ET vs IN b = 2.47, t(48) = 4.63, p < 0.01, CI = [1.40, 3.54]. **significant difference**

NT vs IN , b = -0.02, t(48) = -0.05, p = 0.96, CI = [-0.84,0.80]. not significant

2.3 EN without 'basic'

H2 = F (3,37) = 1.17, p = 0.34, R-sq = 0.09. not significant (same as initial)

NT (M= 4.53) > IN (M= 4.22) > ET (M= 3.79)

ET vs NT = b = 0.74, t (48) = 1.78, p = 0.08, Bootstrapped CI = [-0.11,1.55] not sig

ET vs IN = b = 0.43, t (48) = 1.21, p = 0.23 Bootstrapped CI = [-0.25,1.16]. not sig

NT vs IN = b = -0.31, t(48) = -0.73, p = 0.47, Bootstrapped CI = [-1.01,0.44]. no sig

3.1 Initial Hypothesis

H3: Higher IM = Higher RC, **supported.**

Direct effect on IM (b = 0.78, t(48) = 3.21, p < 0.01, Bootstrapped CI = [0.34,1.28]). **significant**

3.2 EN ALL = showed non-significant results of b = 0.30, t (48) = 0.79, p = 0.44, Bootstrapped CI = [-0.43,1.01].

3.3 Basic EN = direct effect, with a significant result of b = 0.69, t (48) = 2.31, p = 0.03, Bootstrapped CI = [0.19, 1.28].

4.1 Initial hypothesis

H4: IF has an indirect positive effect on RC through IM.

Where RC and IM is the highest in IN > TN > ET

ET vs TN = not significant

ET vs IN = not significant

TN vs IN = not significant

4.2 ALL EN

no indirect effect.

ET vs NT condition (b = 0.50, Bootstrapped CI = [-0.21,1.24] NOT SOG

ET vs. IN revealed that b = 0.49, Bootstrapped CI = [-0.01, 1.02] NOT SIG

NT vs IN: b = -0.49, Bootstrapped CI = [-0.69,0.70]. NOT SIG

4.3 EN without 'basic'

no indirect effect,

ET vs TN (b = 0.51, Bootstrapped CI = [-0.10,1.27]), not sig

ET vs. IN b = 0.30, Bootstrapped CI = -0.20; 0.86 not sig

TN vs IN b = -0.22, Bootstrapped CI = [-0.87,0.36]. not sig

Overview in excel sheet can be accessed here