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„ „ „„ igtt inn illl llli ll nnn tttt RR Raaalil iyy if fifff ff f ff fi n-Based Model: A Case from the Sultanate of Oman

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Abstract: In the context of the rapid dissemination of information, scaffolding the readability of online content is critical. This study introduces the brainling model as a novel approach to measuring readability, which heeds readers' cognition, senses, emotions, and cultural background in conjunction with language. To achieve the aims, two texts covering a general topic were selected, both possessing the same readability level according to the Flesch Reading Ease scale. However, one of the texts was modified in accordance with the brainling components (i.e., cogling, emoling, sensoling, and cultuling). Following each reading text, five multiple-choice comprehension questions, a 10-item Likert scale for readability, and a scale for the text's difficulty level scale were designeds The Google Form was used to collect responses from 209 individuals with intermediate language proficiency at an educational institution in Oman. After verifying the reliability and validity of the questions and scales, significantly higher mean scores were observed for the readability scale components of clarity and engagement in the brainling-based modified text, compared to the unmodified text. Moreover, the results obtained from the text difficulty scale, readers rated the brainling-based text as easier to comprehend. Furthermore, based on the reading comprehension test, participants achieved higher scores when reading the brainling-based text. These findings demonstrate that modifying a text based on the brainling model, which integrates both brain and linguistic structures, significantly enhances clarity, engagement, text difficulty, and reading comprehension scores. Adopting the brainling approach can be a solution for fostering mutual understanding and collaboration among culturally diverse members and alleviating challenges such as misunderstanding, that may hinder goal achievement.

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Introduction

The Internet opens up infinite possibilities to everyone and allows people to access massive online information resources. Online content expedites the dissemination of pieces of information, leading to the availability of data anytime and anywhere. But how easy is it for people to understand them? To this end, the readability concept has emerged to determine how easily content can be read. Readability is an attempt to predict the difficulty level of texts or make them easy and comprehensible. Text comprehension (Kate et al., 2010) and text processing (Crossley et al., 2023) are two notions of readability. Text comprehension involves word and syntactic complexities, and discourse structures (Mesmer et al., 2012); however, text processing is generally associated with the speed of reading (Crossley et al., 2023). A reader-text mismatch in difficulty level may disrupt comprehension. Indeed, the success of readers is determined by the extent to which they can understand texts (Grabowski & Mathiebe, 2024). To check the readability level of texts with regard to the intended readers, several qualitative and quantitative studies have been conducted (e.g., Ahmad & Hasan, 2024; Crossley et al., 2023; Grabowski et al., 2010). As progress in the studies is made, the variety of factors becomes greater.

Historically, emphases on linguistic and syntactic features have made readability attractive in classic studies. Some researchers (e.g., Collins-Thompson & Callan, 2005; Kincaid et al., 1975; Pitler & Nenkova, 2008) presuppose that the employment of formulae (e.g., the Flesch formula, the Fry graph, the Lexile, and Gunning Fog formula) would ensure objective and accurate results. Formulae-based investigations (e.g., Dale & Chall, 1948; Smith et al., 1989; Spache, 1953) measure the difficulty level by word frequency, length, and syllables. Word- and sentence-oriented formulae have hampered studies to encompass important textual factors (e.g., narrative aspect, semanticity, and text cohesion) (Crossley et al., 2023) and extra-textual factors (Schriver, 2000).

Thereafter, the classic readability models have been changed by the idea that the numerical scores may be misleading since the developers considered readability as a monolithic rather than a multifaceted phenomenon (Bailin & Grafstein, 2001). The presupposition underlying the modern formulae is that readability is not reducible to a single and simple measure and should not be limited to the surface properties of texts (Bailin & Grafstein, 2001). Accordingly, the presence ofe readers' characteristics in reading comprehension is undeniable. Hence, readability may be the outcome of readers'

characteristics in association with text properties (Bailin & Grafstein, 2001; McNamara & Kintsch, 1996).

In reviewing multiple factors that affect readability, we intended to investigate that readability is not a matter of a factor or factors. If we consider the extent to which the interaction among the structures of the brain can create unique characteristics, then we can suggest that the demands that unreadable contents place on readers in terms of uniting the words and sentences may be in virtue of the brain-based features. Hence, this study was significant because it suggested a brain-based pattern (i.e., brainling model) that could be befitting to predict the readability of online texts. Introduced by Pishghadam and Ebrahimi (2020), the brainling pattern has four components: Cogling, emoling, sensoling, and cultuling. Cogling reflects the writer's ability to use language in a way that matches readers' background knowledge, thoughts, and intentions, as well as their expectations and needs. Based on the sensoling component, what is readable for a reader who has optimally experienced multiple senses (i.e., seen, heard, tasted, smelled, and touched) is perhaps different from what is easy to read for a person who is unfamiliar with the topic. According to the emoling, the more arousal a text is, the easier it is to be processed. However, this does not mean that positive texts are directly correlated with readability score, but the readers' experiences and their aroused emotions make the text readable or unreadable to them. Finally, the general assumption in cultuling is that a text that may be easily read by readers with a specific cultural background will not be easy for another. The study focused on the implementation of the brainling components in modifying passages (Pishghadam et al., 2023).

To achieve the objective, we administered an online English text with college-level readability and a modified version of another text with a similar readability level that incorporated the brainling components to Omani EFL learners. The obtained readability results were compared with those acquired from contents whose readability was measured by the Flesch index. The rationale behind using the Flesch formula was its popularity in readability studies. The reason for conducting the study among Omani learners was that Oman is a multicultural society and successfully supports the state of coexistence with multifarious ethnicities, languages, nationalities, backgrounds, etc. (Al-Raisi et al., 2019). Moreover, regarding language as an important ramification of cultural diversity in multicultural societies, we specifically delved into examining English as a widely spoken language in Oman. In this respect, the significance of the study was remarking on the

possible association between the brainling pattern and readability as it might enlighten content developers to tailor content with regard to readers' various characteristics.

Following the results of the cognitive (Huckin, 1983), emotional (Pishghadam & Abbasnejad, 2016), sensory (Alarcon et al., 2020), and cultural (Bailin & Grafstein, 2001) approaches to readability, we hypothesized that the efficiency of the brainling components may be highlighted in the answers to the readability-based Likert-scale questions. Moreover, we assume that the inclusion of cogling, emoling, sensoling, and cultuling components into texts could be manifested in the responses to the text difficulty-based Likert-scale question. The third hypothesis is that incorporating the components may make the text more understandable and can manifest differences in the readers' reading comprehension test scores.

Theoretical Framework

Readability

Rendering comprehensible texts well suited to readers' abilities has constantly been a challenge for writers, reviewers, and educators. Researchers (e.g., Chall & Dale, 1995; Crossley et al., 2023; Fry, 1968, 1975; Grabowski & Mathiebe, 2024; Kincaid et al., 1975; Spache, 1953) have endeavored to measure reading comprehension ability and predict the difficulty level of texts. As a solution to these concerns, the readability concept and readability formulae (e.g., Automated Readability Index, Dale-Chall readability formula, Fog Count, and Flesch Reading Ease Formula) have been designed. Readability means the degree to which a reader understands a text (McLaughlin, 1969) and reads it at an optimal speed (Dale & Chall, 1948). Since the 20th century, readability studies have been commenced by Thorndike's (1921) book. The traditional readability measures (e.g., Dale-Chall readability formula, Chall & Dale, 1995; Reading Ease Readability Formula, Flesch, 1948; Automated Readability Index, Fog Count, and Flesch Reading Ease Formula, Kincaid et al., 1975) heed mostly to the surface-level linguistic features. The classic readability formulae evaluated the effects of word/sentence length, and word frequency as the core components of the analysis. For instance, word length was the core component in Flesch's (1948) study, and word frequency, percentage of unfamiliar words, and average sentence length were noticed in Dale-Chall's (1948) formula. The formulae adopted proxy measures and calculated the "number of characters per word", besides the "number of words per sentence" for word complexity and syntactic sophistication analyses (Crossley et al., 2019).

However, the classic readability formulae have been criticized for their overdependence on quantitative factors leading to the negligence of qualitative variables (e.g., sociocultural and psychological). In particular, they failed to account for the fact that various sociocultural groups may shape copious vocabulary repositories over time (Lenzner, 2014). Actually, in the assessment of this multicomponent skill, readers' background knowledge may finely adjust their reading comprehension (Davison & Kantor, 1982). As a result of the shift of focus from text-based to reader-based analysis, the psycholinguistic-based model of analysis reckons the nexus between readers' interaction and the textual factors (e.g., cohesion and coherence) (Gernsbacher, 1997).

A synthesis of the advances in corpus and computational linguistics together with psycholinguistic and discourse-level analyses had been accomplished in the Coh-Matrix formula (Graesser et al., 2004). The formula is based on discourse processing and computational linguistics and takes notice of world knowledge, language, and discourse features together with cohesion relations (Graesser et al., 2004). To improve the readability concept, Pishghadam and Abbasnejad (2016) were critical of previous models for not accounting for readers' senses and emotions. To fill the gap, they propose an emotioncy-based model [sense (emotion + frequency)] of readability. Based on the model, readers' comprehension correlated with their emotioncy levels (i.e., sensory-induced emotions). In this respect, the reading difficulty level depends on human-oriented experiences rather than textual factors. Based on advances in computational linguistics, Crossley and colleagues (2019) develop new readability formulae to delineate readers' judgment of texts, reading speed, and understanding. Crossley et al. (2023) stated the CommonLit Ease of Readability corpus can provide unique readability scores.

Generally, readability formulae have been widely used in educational centers, though they have often been criticized for a variety of weaknesses. Classic studies were mainly centered on text understanding analysis; however, focuses shifted to ease of text processing. In modern readability models, multiple qualitative factors together with readers' internal factors in reading comprehension and making meaning out of texts come to power. The following part is devoted to the explanation of a brain-based model delineating its components as the framework of this study and a possible solution for modifying readability.

Brainling

It has long been established that the human brain consists of three (i.e., the reptilian brain, limbic brain, and neocortex) integrated structures (MacLean, 1978). To regulate functions

(e.g., emotions, cognition, language, memory, etc.), the structures are interconnected and do not operate independently. From this perspective, Pishghadam and Ebrahimi (2020) introduce the "brainling" pattern to clear up the significance of cognition, emotions, senses, and culture in connection with language. Based on the brainling pattern, language reflects brain macro functions and the interactions between them facilitate effective communication (Pishghadam & Ebrahimi, 2020). But the complexity of the brain, language, and communication does not stop here. The brainling pattern portrays this intricacy by delineating four components. The brainling components are as follows:

Cogling (cognition + language) demonstrates the manifestation of language in thoughts shaping individuals' interpretations of the world. In this view, individuals' visions are in connection with their word repertoires. On top of that, the selection and arrangement of words emerge a multitude of effects on interlocutors during communication. In this regard, language is a tool for better thinking, and via language, humans can communicate their thoughts.

In the emoling (emotion + language) component, the language that a person uses has positive or negative emotions. In this light, some concepts are positive or negative in essence, called automatic emotion. However, the positivity or negativity of some events is cross-culturally and/or interpersonally different, called deliberative emotions. As a result, emotions involved in language are not fixed, but dynamic. In bidirectional effects, the game of language is in fact the game of emotions paving the way for the game of thoughts (Ghadirzade Toosy & Jajarmi, 2023; Jahani & Aminzadeh, 2024).

Cultuling (culture + language) mirrors the interconnection between language and culture (Pishghadam, 2013). Cultuling analysis foregrounds unique language structures and phrases of a language entrenched in a nation. Cultuling awareness has profound positive effects on socialization.

Sensoling (sense + language) encompasses physical and linguistic senses. While the physical sense refers to the sensory inputs and channels, the linguistic sense frames issues related to communication. Sensoling highlights the impacts of sensory inputs on language. If mapped and employed correctly, sensory inputs illustrate a clear picture of the environment. Optimal sensory involvement creates thick-slice sensory relations (Pishghadam, 2018).

Generally, for effective communication, attention to the interlocutors is as important as attention to their thoughts, emotions, senses, and culture. Brainling pattern portrays a unified image of language and the brain leading to changes in behaviors. In this respect, our idea is that how the brain and language assist readers in comprehending texts should be studied with

particular reference to their brain-based unique characteristics and experiences (e.g., cognitive, sensory, cultural, and emotional features).

Methodology

Participants

The participants of the current study were 209 individuals who had intermediate levels of language proficiency (i.e., 30 to 40 out of 60) based on the Oxford Quick Placement Test (Allan, 1992). They were recruited from an educational institution in Oman using a convenience sampling method. The researchers selected the participants who were available and willing to participate in the study, without applying any specific criteria or randomization. The majority of the participants (94.7%) were Omani nationals, while the rest were from Yemen (2.4%), Tunisia (1.9%), and Jordan (1%). The gender distribution was fairly balanced, with 52.6% females and 47.4% males. The participants were from 17 to 37 years old (M = 20.07, SD = 2.69). The educational level of the participants varied from foundation to master, with 50.7% having a bachelor's degree, 1.9% having a master's degree, and 47.4% being in the foundation program.

Instrument

To conduct the study, two online English passages with general topics were utilized. The passages consisted of 500 words and to measure the readability level of the passages, the Flesch Reading Ease score formula (Flesch, 1948) was used. Their readability level was analyzed by https://readability formulas.com/. Accordingly, their Flesch Reading Ease scores were between 30-50 indicating the college student reading level. One of the texts remained unchanged, but the other was modified based on the concepts of cogling, emoling, sensoling, and cultuling. Adjusting a text based on the cogling concept involves simplifying complex ideas and structures to ensure that they align with readers' cognitive processes. The emoling concept engages the use of words with positive or negative connotations to connect with the readers' emotional levels. Furthermore, creating more vivid sensory experiences through the five senses enabled the application of sensoling. Finally, adapting the text to the readers' cultural background and the incorporation of culturally relevant examples modified the text based on the cultuling concept. Notably, the readability level did not change after the modifications.

An example is provided to clarify the modification; the second sentence is an adjustment of the first one:

1) Our beautiful ecosystem is being systematically damaged by industrial pollution channeled into rivers like the Ganga and the Yamuna, nuclear wastes from atomic plants routed into the world's oceans, and poisonous gases such as carbon dioxide mixed with the ozonosphere.

2) Our beautiful ecosystem is like a precious jewel that shines with different colors and shapes; however, it is being damaged by industrial pollution that goes into rivers like the Wadi Dayqah and the Wadi Bani Khalid, nuclear wastes that are dumped into the Arabian Sea, and poisonous gases that harm the ozone layer.

Following each reading text, five comprehension multiple-choice questions were designed. Afterward, as the second task, a 10-item Likert-scale readability (1= Strongly disagree; 2= Disagree; 3= Neutral; 4= Agree; and 5= Strongly agree) was created to evaluate the texts' clarity and engagement. As clarity and engagement are two components of readability (Ghafourian et al., 2023; Hartley, 1994), each accounted for half of the questions. The clarity questions pertained to the clarity and understandability of the passages, their organization, and coherency, the appropriateness of vocabulary and grammar, the clear presentation of main points and concepts, and the avoidance of unnecessary jargon and technical terms. The engagement questions focused on whether the passages were interesting and engaging, suitable for the intended purpose and audience, provided examples and illustrations to support arguments, stimulated readers' curiosity, and motivated them to learn more or take action. Finally, task 3 involved a question about the text's difficulty level, asking participants to rate it on a scale from 1= Extremely easy to 5= Extremely difficult (See Appendix).

Procedure

The two passages with general topics and a similar difficulty level were inserted into Google Forms. As the first step, the participants were asked to complete the demographic section It was followed by the first passage, which participants were asked to read carefully before selecting the best answer from the provided options based on the information presented in the passage. The aim of Task 1 was to ensure the extent to which the participants truly comprehended the passage. In Task 2, they were asked to indicate the degree to which they agree or disagree with each of the statements about the text they have read, using a 5-point Likert scale (from 1= strongly disagree to 5= strongly agree). Then, in Task 3, they were asked to determine the difficulty level of the text from 1= Extremely easy to 5= Extremely

difficult. The same format of the tasks was repeated for the second text which was modified by the brainling model.

Data Collection

The recorded data were imported into IBM SPSS Statistics software (version 25) to check the reliability of the Readability Scales and the underlying subconstructs through Cronbach's alpha and test-retest model. Then, AMOS was run to verify the construct validity of the Readability Scale. In the third step, correlational analysis for readability, reading score, and text difficulty was examined through the Pearson product-moment correlation. Finally, a paired samples t-test was conducted to compare the readability, reading scores, and text difficulty between text 1 and text 2.

Results

Table 1 shows descriptive statistics for the readability of text 1 and text 2.

Table 1. Descriptive Statistics for the Readability of Text 1 and Text 2

	Min	Max	Mean	SD
Readability of Text 1	10.00	49.00	27.77	8.36
Clarity	5.00	25.00	14.01	4.20
Engagement	5.00	25.00	13.76	4.63
Reading Score	0	5	2.10	1.18
Text Difficulty	1	5	3.44	.96
Readability of Text 2	12.00	50.00	33.17	9.72
Clarity	5.00	25.00	16.52	5.30
Engagement	5.00	25.00	16.65	5.03
Reading Score	0	5	2.51	1.36
Text Difficulty	1	5	2.84	1.17

Reliability Estimates

Table 2 shows the reliability estimates for the Readability Scales, in addition to its underlying subconstructs. As can be seen, Cronbach's Alpha estimates are all above .70, which is considered acceptable. Moreover, the reliability of the text difficulty item was verified

through the test-retest method. The correlation coefficient of the measured values, calculated at two separate time intervals, was estimated as r = .94.

Table 2. Reliability Estimates for the Readability Scale

	N of Items	Cronbach's Alpha
Readability	10	.91
Clarity	5	.88
Engagement	5	.84

Validation of the Readability Scale

In order to verify the construct validity of the Readability Scale, Confirmatory Factor Analysis (CFA) was used, Harman's single-factor test was calculated before running the CFA. Based on the result of the test, the first factor accounted for only 47.05% of the variance and confirmed the construct's multi-dimensionality. The scale has two subconstructs of Clarity (5 items) and Engagement (5 items). To improve model fit, no items were eliminated from the scale. See Table 3 for the Goodness-of-fit indices.

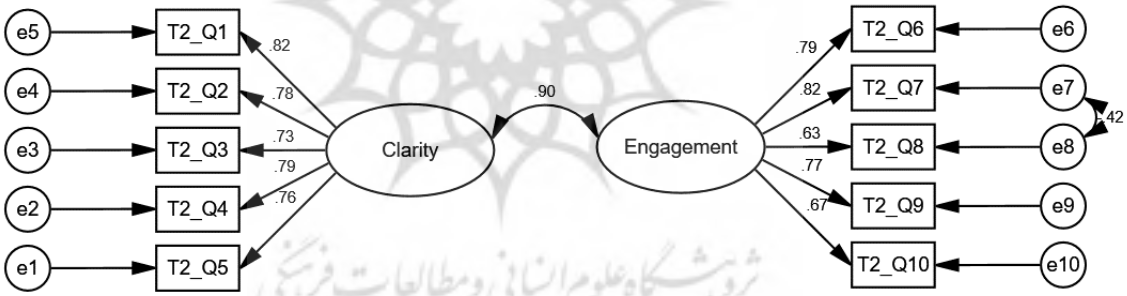

Figure 1. Measurement Model for the Readability Scale

To check if the model fits the data, goodness of fit indices were measured in Amos. The criterion for accepting the model is different according to different researchers. In the present study, values for χ^2/df (i.e., chi-square index divided by the degrees of freedom (χ^2/df) should be less than 3 (Ullman, 2001), Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) were over .90, and Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Squared Error (SRMR) were equal to or less than .08 (Browne & Cudeck, 1993).

Table 3. Goodness of Fit Indices for the Model

Models	χ^2/df	df	CFI	TLI	RMSEA	SRMR
The Readability Scale	2.04	32	.97	.96	.07	.04

Correlational Analysis

The Pearson product-moment correlation was used to examine the possible relationships between readability, reading score, and text difficulty for text 1 (Table 4) and text 2 (Table 5). The results, presented in Tables 4 and 5, show that some of the variables have statistically significant correlations with each other.

According to Table 4, the readability of text 1 has a positive relationship with the participants' reading score (r = .21, p < .01) and a significant negative relationship with text difficulty (r = -.48, p < .01). There exists no significant relationship between text difficulty and the participants' reading score.

Table 4. Correlational Analysis for Readability, Reading Score, and Text Difficulty (Text 1)

	Readability	Reading Score	Text Difficulty
Readability	1		
Reading Score	.21**	1	
Text Difficulty	-.48**	-.03	1

**. Correlation is significant at the 0.01 level (2-tailed).

According to Table 5, readability of text 2 has a positive relationship with the participants' reading score (r = .44, p < .01) and a significant negative relationship with text difficulty (r = -.49, p < .01). There is also a significant negative relationship between text difficulty and the participants' reading score (r = -.45, p < .01).

Table 5. Correlational Analysis for Readability, Reading Score, and Text Difficulty (Text 2)

	Readability	Reading Score	Text Difficulty
Readability	1		
Reading Score	.44**	1	
Text Difficulty	-.49**	-.45**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Mean Differences

In order to examine if there are any significant differences in the readability, reading score, and text difficulty between text 1 and text 2, a series of paired samples t-tests were run.

As Table 6 shows, there are significant differences in readability (t (208) = -6.49, p = 0.000), reading score (t (208) = -3.31, p = 0.001), and text difficulty (t (208) = 5.92, p = 0.000) between text 1 and text 2. Text 2 appears to be easier than text 1 and, therefore, has higher readability and reading scores.

Table 6. Paired Samples t-Test for Readability, Reading Score, and Text Difficulty of Text 1 and Text 2

	Variable	N	Mean	SD	df	t	Sig. (2-tailed)
Readability	Text 1	209	27.77	8.36	208	-6.49	.000
	Text 2	209	33.17	9.72			
Reading Score	Text 1	209	2.10	1.18	208	-3.31	.001
	Text 2	209	2.51	1.36			
Text Difficulty	Text 1	209	3.44	.96	208	5.92	.000
	Text 2	209	2.84	1.17			

Discussion

Text readability which pertains to the comprehensibility of words and sentences is an attribute of multiple factors like clarity, engagement, and text difficulty (Hargis et al., 2004). To examine this crucial factor in language learning, this study analyzed two texts that had similar readability scores according to the Flesch Reading Ease score readability formula, targeting Arab English language learners. Notably, one of the texts incorporated brainling theory. This part aims to provide a comprehensive discussion of the findings obtained through a five-point Likert readability scale, a text difficulty scale, and reading comprehension scores.

The results confirmed our first hypothesis, which acknowledged that constructing the text based on brainling components (i.e., cogling, emoling, sensoling, and cultuling) resulted in higher levels of readability compared to the text created using the Flesch Reading Ease score readability formula. Specifically, the significant differences in the participants' responses to the five-point Likert readability scale between the two texts evidenced that the quadripartite model of the brainling theory significantly enhanced clarity and engagement. Several studies have also integrated readability into information quality assessment, highlighting its presence in clarity (e.g., Hartley, 1994; Temnikova et al., 2015; Velez & Ashworth, 2007) and engagement (e.g., Ghafourian et al., 2023; Leonhardt & Makienko,

2018). In particular, well-organized and coherent texts (Meyer, 2003) with appropriate vocabulary and grammar (Chall & Dale, 1995; Zamanian & Heydari, 2012; Worrall et al., 2020), as well as clear explanations of main points and concepts (Heydari & Riazi, 2012) are considered more readable. These results are in line with the findings of Sanatipour et al. (2024), which employed the brainling model to systematically analyze commonly used English textbooks in both private and state educational settings. Their study entailed a specific analysis of the reading comprehension difficulty (cogling), the cultural appropriateness of content and visuals (cultuling), the presence of positive and negative language and the fostering of motivation (emoling), and the engagement of sensory experiences (sensoling). Significant differences were identified among the English textbooks used in different educational settings. According to teachers' and students' responses, the lowest component used in state schools was emoling, while the lowest component in textbooks used in private schools was cultuling. Sanatipouret al.'s (2024) analysis revealed the absence of certain components derived from the brainling model in these textbooks.

Building upon this understanding, the current study compared the comprehensibility of two texts with the same Formula Readability score, while incorporating brainling components into one of the texts. The findings revealed that the modified text exhibited a higher readability score compared to the other, indicating the positive effect of incorporating brainling elements on improving comprehensibility. Therefore, it can be assumed that adjusting a text based on brainling principles can be helpful for language learners. Such an account provides the implication that a text amended according to the brainling principles would be more readable, thereby enhancing clarity and fostering engagement. Language learners would benefit from reading texts that incorporate cogling, emoling, sensoling, and cultuling.

Furthermore, considering the Internet as an important source of information, studies (Gallagher et al., 2017; Worrall et al., 2020) have analyzed the readability of online texts. When examining online texts, Gallagher et al. (2017) reported a lack of correlation among the readability formulae and measures. Based on their findings, they mentioned that "online texts were the most disparate with respect to text difficulty" (p. 1). Worrall et al. (2020) also found significant differences in readability scores between various web pages. They emphasized the importance of ensuring universal readability in online texts and urged webpage producers to be aware of readability levels to enhance understanding. Although these authors compared and analyzed the comprehensibility of online texts, they failed to

provide any practical solutions. In light of our findings on clarity and engagement, the brainling approach can be suggested as a practical solution to this problem.

The third task results indicated that the brainling-modified text received higher mean scores for ease of understanding compared to the unchanged text. In other words, the participants found the brainling-modified text as easier despite both texts having similar Flesch Reading Ease scores. Considering text difficulty as a key indicator of readability (Cunningham & Anne Mesmer, 2014; Jian et al., 2022; Zhang, 2022), we deduced that modifying texts based on the brainling components could enhance comprehension. To be specific, the brainling model goes beyond treating readability as a singular or multiple factor and considers the interaction among brain structures. Consequently, we found that brainling-based modifications could lower the text difficulty level. These conclusions were further reinforced by the findings on the readers' reading comprehension scores.

The increase in mean scores in comprehending the brainling-based text supports the third hypothesis, which posits that incorporating cogling, emoling, sensoling, and cultuling components may make the text more understandable and can manifest differences in the readers' reading comprehension test scores, indicating that the scores are significantly improved through these modifications. Considering reading scores as a means of assessing readers' comprehension (Scott, 2008), we found that incorporating readers' cognition, emotion, sense, and culture in conjunction with language can enhance their comprehension. We also deduced that attending to the brain's structure is required to provide a readable text. In particular, reading comprehension involves mental processes that can be promoted by aligning with the brain's structure and function, rather than relying solely on formulae. Actually, material developers have used formulae results as "explanations of difficulty" rather than "predictors of difficulty" (Crossley et al., 2008). Such scores can emanate the erroneous impression that embedding short and uncomplicated words in short sentences can make texts readable. We imply that the logic behind the formulae cannot adequately represent readability since they may overlook readers' fundamental characteristics.

Conclusion

Overall, our findings demonstrate that modifying a text based on the brainling model, which combines brain and language structure, is a significant factor in text modification. However, this consideration has been overlooked in the creation of readable texts. This study does not negate the role of classical factors (e.g., word, sentence, grammatical complexities, frequency, etc.) in readers' cognitive demands. We also do not argue that readability

formulae's results are untrustworthy; rather, they fail to capture some essential reader features. Our idea is that exploring how the brain and language assist readers in comprehending texts should involve studying their brain-based unique characteristics and experiences (e.g., cognitive, sensory, cultural, and emotional features). Thus, we believe that studies should shift their focus from text- and reader-based analyses to considering readers' brain structures.

Our findings suggest that implementing brainling components will provide content developers with the opportunity to tailor online content to readers' basic characteristics. In particular, considering Oman is a multicultural society with multifarious ethnicities, languages, nationalities, backgrounds, etc. (Al-Raisi et al., 2019), targeting text comprehensibility can support coexistence among culturally diverse members and alleviate challenges such as misunderstanding that may hinder goal achievement. In this vein, adopting the brainling approach can be a solution for fostering mutual understanding and collaboration. In general, this study has fruitful implications for educational communities. With regard to the increasing prominence of standardized tests and texts, the results can help teachers and test designers in developing readable texts. This, in turn, would enable teachers to identify readable texts that incorporate an appropriate match to readers' cognition, emotions, senses, and culture, facilitating reading comprehension and conceptual processing.

While the research has achieved its objectives and has been meticulously prepared, there are several limitations to consider. The first limitation is directed towards the method of study. To obtain a more detailed insight into the readability level, complementary studies could be conducted with more than two texts and extended passages involving readers with various proficiency levels. Furthermore, correlating the results of the brainling-based text with unmodified texts, whose readability is determined using multiple readability formulas, could further strengthen the study's findings. Additionally, future research could replicate the investigation with a larger sample size and more diverse groups.

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Appendix

Task 2

Please indicate how much you agree or disagree with each of the following statements about the text you have read, using a 5-point Likert scale (1= Strongly disagree; 2= Disagree; 3= Neutral; 4= Agree; and 5= Strongly agree).

Questions	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. The text was clear and easy to understand.	1	2	3	4	5
2. The text was well-organized and coherent.	1	2	3	4	5
3. The text used appropriate vocabulary and grammar.	1	2	3	4	5
4. The text explained the main points and concepts clearly.	1	2	3	4	5
5. The text avoided unnecessary jargon and technical terms.	1	2	3	4	5
6. The text was interesting and engaging.	1	2	3	4	5
7. The text was suitable for its purpose and audience.	1	2	3	4	5
8. The text used examples and illustrations to support the arguments.	1	2	3	4	5
9. The text stimulated my curiosity and interest in the topic.	1	2	3	4	5
10. The text motivated me to learn more or take action.	1	2	3	4	5

Task 3

How difficult did you find the text?

Extremely easy O Easy O Average O Difficult O Extremely difficult O