

Exploring the Efficacy of ChatGPT in Adapting Reading Materials for Undergraduate Students

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Abstract

Current research explores the efficiency of ChatGPT 3.5 in text adaptation for educational purposes. It aims to investigate reliability of the AI model for reading ease evaluation, its accuracy in reading manipulation on specific parameters, output quality, and prospects of improving user experience. The study considered text, sentence, and word length as the main features for measuring text difficulty. Flesch-Kincaid reading ease statistics was used for input and output text accessibility evaluation. The research identifies the areas of concern of using ChatGPT 3.5 for text manipulation and requirements for successful implementation of the AI model in the process of the reading materials transformation.

Keywords: *text adaptation; reading accessibility; reading manipulation; ChatGPT 3.5, human involvement.*

1. Introduction

Reading effectively is a crucial skill that unlocks a world of knowledge, leading to greater success and personal development. As educators, it is our responsibility to not only encourage students to read but also ensure they comprehend and learn from the material. To achieve this goal, we must design teaching materials that enhance their language abilities and foster a love of reading. Adapting texts to suit the varied needs and comprehension levels of students is an essential task for educators. This becomes particularly challenging in international undergraduate settings where students possess diverse backgrounds, learning styles, and proficiency levels (Murphy, 2013). To address this challenge, there is a need for innovative solutions that can assist language teachers in tailoring reading materials to meet the unique requirements of their students.

ChatGPT, as a cutting-edge language model designed to comprehend and generate human-like text, can be a life-changing experience for those involved in the text adaptation process. The ability of the AI model to understand and respond to user inputs makes it a collaborative and

interactive tool the right use of which can elevate both student and educator experience to a new level. Leveraging the capabilities of ChatGPT in education presents a promising pathway for language teachers to efficiently adapt reading materials (Plevris et al., 2023).

This research explores the efficacy of ChatGPT 3.5 (further ChatGPT) in the context of undergraduate education for international students, shedding light on its potential as a text manipulation tool.

2. Purpose of the study

The current research aims to explore the functionality of ChatGPT for text adaptation in the context of undergraduate education. The target audience of the study is international students, and the target level of reading complexity is 30-50 (college students). The study explores the efficiency of ChatGPT in (1) evaluating reading accessibility in comparison with acknowledged tools and (2) adapting reading to specific parameters.

3. Research questions

1. How accurate is ChatGPT evaluation of text readability?
2. How accurate is the output of ChatGPT based on predetermined text accessibility parameters?
3. How does the use of ChatGPT impact the efficiency of the text adaptation process?

4. Literature review

Accessibility of learning resources plays a critical role in undergraduate education (Roberts, 2014; Goodman & Freeman, 2013; Case, 2012; Kuimova & Kobzeva, 2011). Text adaptation for undergraduate students is a significant pedagogical consideration as educators face a variety of student backgrounds and learning styles (Murphy, 2013).

It is often argued that students do not understand texts written by native speakers in the same way that native speakers do, hence learning materials comprising reading should be accessible enough to ensure academic progress and success of an undergraduate learner (Krashen, 1988). It is important to take the reader's proficiency into account when selecting specific learning content as text complexity has a direct bearing on how motivated the students are. It would be inappropriate to assign a text that is outside the scope of comprehension for the students, since this could demotivate them to learn (Case, 2012).

Accessibility of learning materials can be adjusted by an educator by using a range of readability formulas and instruments available online. Readability is defined as "The sum total (including all the interactions) of all those elements within a given piece of printed material that affect the

success a group of readers has with it. The success is the extent to which they understand it, read it at an optimal speed, and find it interesting” (Dale & Chall, 1949, p. 12).

Currently, the number of reading accessibility formulas that measure text complexity exceeds 200 (DuBay, 2004). They are utilized to evaluate the text from the point of view of its readability by a specific group of students. The formulas might differ in terms of the quality of their output, features for measurement, and hence their success (Torki, 2013).

The Flesch-Kincaid Reading Ease formula (Currier, 1977) is one of the most popular measurements researchers and educators use. It calculates the reading complexity based on a score from 0 to 100, where 0 means the text is very difficult to read and 100 indicates its high accessibility. In addition, the formula identifies the grade of the assessed reading, indicating the grade-school level the text is accessible for.

Table 1. Flesch-Kincaid Reading Ease score

Score	School grade	Readability
90 - 100	5th	Very Easy
80 - 90	6th	Easy
70 - 80	7th	Fairly easy
60 - 70	8th – 9th	Standard
50 - 60	10th – 12th	Fairly Difficult
30 - 50	College	Difficult
0 - 30	College graduate	Very Difficult

This tool is used in the current study to explore the efficiency of ChatGPT in adapting reading complexity to a required accessibility level.

Text adaptation is a laborious procedure that takes a lot of an educator's time, attention to detail, and effort. The emergence of several AI models is expected to benefit educators appropriately (Plevris et al., 2023). According to experts studying artificial intelligence models, one benefit is modifying course materials for more individualized instruction without increasing the teacher’s workload (Fütterer, 2023; Mondal & Mondal, 2023; Pearce, 2023).

ChatGPT is one of the most widely used AI models nowadays. GPT, short for Generative Pre-trained Transformer, is a language model developed by OpenAI. ChatGPT is crafted to produce text responses that resemble human language, drawing from input. ChatGPT employs deep learning techniques to comprehend and generate text. Its training involves extensive data collection from the internet and various sources, enabling it to grasp language patterns and structures (Plevris et al, 2023). All you need to do is to provide a well-thought-out, detailed prompt to receive the desired output of appropriate quality (Chamurlyiski, 2023). Educators and researchers widely discuss multiple benefits and drawbacks of the model in different fields. ChatGPT, with a different level of success, can summarize text, produce outlines for essays,

write sections for research papers, perform statistical analysis, and solve math problems (Mondal & Mondal, 2023; Plevris et al., 2023). However, numerous researchers point out that the AI model does not encourage critical thinking, produces output with unreliable information, and even generates plagiarized content (Fütterer, 2023; Mondal & Mondal, 2023).

There are multiple investigations on the successful utilization of ChatGPT for text generation. However, to our knowledge, no research has been done yet on the efficiency of ChatGPT in text adaptation. Hence, current study aims to explore this niche to identify capabilities, accuracy, and human dependence of the AI model in reading manipulation for international undergraduate students.

5. Methodology

5.1. The source

The current study describes an experiment on ChatGPT usability for text adaptation for international undergraduate students.

The reading material used for the investigation was a paragraph from the text 'Digital natives or digital refugees? Why we have failed Gen Y' by Combes (2009). The text was used as an input for ChatGPT to explore its efficiency in text evaluation and adaptation to a selected level. ChatGPT was utilized for the current experiment. Prompts were created to generate output that meets the needs of non-native English-speaking undergraduate students.

The study was preceded by an interview with ChatGPT (ChatGPT, January 15, 2024) on its knowledge, information access breadth, and self-assessment of its capabilities and drawbacks on text evaluation and manipulation (see Table 2). The AI model was asked three questions about the Flesch-Kincaid Reading Ease tool utilized for human adaptation of the text under study. The interview was conducted for two reasons: (1) to ensure ChatGPT is aware of the above instrument and can use a similar approach to text evaluation if requested, (2) to enable a consistent analysis of the output by ChatGPT in terms of its quality and accuracy.

Based on the obtained response, ChatGPT is aware of the Flesch-Kincaid Reading Ease tool; it can analyze text complexity based on the suggested tool and modify a text to a certain reading ease score stated in the prompt. The study reports one possible response that ChatGPT could provide for those questions.

Table 2. Interview with ChatGPT

#	Question	Answer
1	Do you know what Flesch-Kincaid Reading Ease formula is?	<p>Yes, I'm familiar with the Flesch-Kincaid Reading Ease formula. It is a widely used method for evaluating the readability of English text. The formula generates a numerical score that reflects the ease or difficulty of reading a particular piece of text. The higher the score, the easier the text is considered to be.</p> <p>The formula is based on two factors: average sentence length and average number of syllables per word. The Flesch-Kincaid Reading Ease score is calculated using the following formula:</p> $206.835 - (1.015 \times \text{average words per sentence}) - (84.6 \times \text{average syllables per word})$
2	Can ChatGPT accurately analyse a text based on Flesch-Kincaid scale?	Yes, I can certainly help analyze a text based on the Flesch-Kincaid readability scale. ...I can calculate the Flesch-Kincaid Reading Ease score for you and offer insights into the readability of the text.
3	Can ChatGPT modify a text to match a specific score based on Flesch-Kincaid scale?	Certainly! If you provide me with the text you'd like to adapt, along with the target Flesch-Kincaid Reading Ease score, I can attempt to modify the text to align with the specified readability level.

5.2. Procedure

The selected reading was analyzed with the help of the Flesch-Kincaid reading ease tool (see Table 1). An experimental input on reading ease analysis of the text under study was given to ChatGPT to compare the actual text accessibility evaluation provided by Flesch-Kincaid statistics to the output of the AI model for accuracy.

The process of adapting a text with ChatGPT included three steps:

Step 1: Writing clear instructions for the AI. The output of ChatGPT depends on the clarity of instructions provided in the prompt. The more precisely the requirements are described, the better output can be expected. This condition was considered at the stage of prompt design. The prompts were worded carefully to ensure ChatGPT understands the parameters of the expected manipulation result. Every output was regenerated twice for result consistency assessment.

Step 2: Reviewing the output. The generated material was inspected to ensure the desired result was achieved. The Flesch-Kincaid reading ease tool was used to review each output of ChatGPT after every input.

Step 3: *Iterating*. If the review showed unsatisfactory output, Steps 1 and 2 were repeated to obtain a better result. The criteria for identifying the output quality were the Flesch-Kincaid statistics of the text under study.

6. Results

The experiment on ChatGPT text manipulation was a three steps procedure that included (1) designing a prompt instructing the model on requirements to the adaptation, (2) evaluating the output of text transformation with the Flesch-Kincaid statistics tool, (3) returning to amending input instructions in case the output did not satisfy the expectations of reading accessibility defined in the prompt.

The experimental comparison was conducted to research the accuracy of ChatGPT reading ease evaluation.

6.1. Experimental comparison

The results of the interview with ChatGPT showed that the model is aware of the Flesch-Kincaid statistics tool and can adapt the provided reading to match a certain reading ease score (see Table 2). However, considering the possible inconsistency in ChatGPT output (Fütterer, 2023), it was decided to explore the AI model accuracy and level of consistency in identifying text difficulty before the main experiment.

Prompt 0: “Please evaluate the reading ease of the following text based on the Flesch-Kincaid statistics scale”.

Below, you can find the results of the experimental accessibility evaluation of the text used for the current study. ChatGPT was requested to generate and then regenerate the response based on the same Prompt 0. Overall, three evaluation attempts were made to investigate the range and caliber of the AI model output. Table 3 presents the Flesch-Kincaid statistics compared to three reading ease evaluation attempts by ChatGPT.

Output 0.1 was descriptive and contained no text complexity score. The explanation provided by the model was as follows: “I don't have the exact word and syllable counts for your provided text, but I can offer a general assessment based on its characteristics. Given the nature of the content, it might fall in the range of a high school or college reading level” (ChatGPT, January 15, 2024). Here we can see a mismatch between ChatGPT's response to interview Question 2 where it stated that it “...can calculate the Flesch-Kincaid Reading Ease score ... and offer insights into the readability of the text” (see Table 2) and the output quality it provided in response to the prompt requesting the model to assess text accessibility based on Flesch-Kincaid statistics scale.

Table 3. Comparison of text reading ease evaluation by Flesch-Kincaid statistics tool and ChatGPT

Readability statistics details	Flesch-Kincaid statistics	Output 0.1 statistics	Output 0.2 statistics	Output 0.3 statistics
Flesch reading ease	13	“...high school or college reading level”	32.2	44.4
Flesch-Kincaid grade level	22.9		15.5	12.5

Outputs 0.2 and 0.3 generated numeric data despite the response found in Output 0.1. Statistical data retrieved after two response regenerations varied from 32.2 to 44.4 points on the readability scale. In terms of accessibility of the analyzed text, both results fall within the score of 30 – 50, which identifies the text as ‘difficult’. The readability level identified by ChatGPT Output 0.2 is 15.5, which is equivalent to a college sophomore or higher, and Output 0.3 is specified as 12.5, a high school graduate accessibility level.

Based on the Flesch-Kincaid formula evaluation, the text under study score equals 13 points, which places it within the range of 0 – 30 points on the reading ease scale, and the grade level is 22.9, which means the text in question belongs to the category of ‘very difficult’ reading accessible for college graduates.

The data above demonstrates multiple gaps in the reliability of ChatGPT in reading ease evaluation. First, the AI model is inconsistent in its evaluations as it provides different results every time the user requests regeneration. The output ranged from a descriptive evaluation with no statistical data (see Output 0.1) to numeric output with different values (see Outputs 0.2 and 0.3). Secondly, neither ChatGPT descriptive nor the two numeric outputs match the actual score of the text complexity provided by Flesch-Kincaid statistics with the tendency towards exaggerating the accessibility of the text under study.

6.2. Main experiment

6.2.1. Writing a prompt

Following the three-step process of the experiment, a prompt was designed for ChatGPT requesting the model to manipulate the input text. In the pre-research interview, the chatbot claimed that it is familiar with the Flesch-Kincaid reading ease formula and can adapt a text to a required readability score (see Table 2).

Prompt 1: “Please adapt the readability of the provided text to the score range of 30 - 50 based on the Flesch-Kincaid reading scale”.

Prompt 1 focuses on the reading ease scale that is widely used for evaluating text accessibility by educators. A specific reading score was selected for precise identification of the level of reading complexity/accessibility expected as an output.

As long as the model claimed its familiarity with Flesch-Kincaid statistics and responded positively to the inquiry on whether it can adapt the text to a specific score on the reading ease scale, it was expected that ChatGPT would simplify the reading in question by changing text and sentence length, amending word count, and rephrasing passive structures.

6.2.2. Review

The input text readability score equals 13, which is within the range of 0 – 30 on the Flesch reading ease scale. Texts with this score are described as “very difficult” to read. The grade level of the input text is identified as 22.9 (see Table 3), which means it is accessible to college graduates.

Prompt 1 requested ChatGPT to adapt the text based on the Flesch-Kincaid reading ease scale to the score range of 30 – 50, which would make the text accessible to college students. The selected range means that the input text needed to be simplified in terms of its accessibility. Table 4 below compares the Input text statistics and the three received outputs by ChatGPT (ChatGPT, January 15, 2024).

Table 4. Comparison of input and output texts accessibility on Flesch-Kincaid scale

Flesch-Kincaid parameters	Input text statistics	Output 1.1 statistics	Output 1.2 statistics	Output 1.3 statistics
Words	231	200	203	195
Sentences	5	5	8	6
Words per sentence	46.2	40	25.3	32.5
Passive sentences	40%	80%	12.5%	16.6%
Flesch reading ease	13	10.5	8.5	5.9
Flesch-Kincaid grade level	22.9	21.7	18.3	20.5

The data provided in Table 4 demonstrates that each ChatGPT output increased reading difficulty of the Input text instead of making reading more accessible. Word count amendments can be noticed in every output: from 231 in the Input text, the number of words changed to 200, 203, and 195 in every next text version accordingly. As for the number of sentences in the manipulated reading, there is no difference between the Input text and Output 1.1, as each

contains 5 sentences. To compare, there is an increase in the number of sentences in Output 1.2 (8 sentences) and Output 1.3 (6 sentences). The number of words comprising transformed texts reduced in all the outputs generated by ChatGPT from 40 lexical items in Output 1.1 to 25.3 in Output 1.2 and 32.5 words per sentence in Output 1.3. Passive sentences underwent remarkable transformations. Their number doubled from 40% in the Input text to 80% in Output 1.1, increasing the complexity of the reading. Regenerated texts in Outputs 1.2. and 1.3 contained a considerably lower percentage of passive sentences (12.5% and 16.6%, respectively). Reading ease score of the Input and Output texts under study remained within the same range: 0 – 30 points. Flesch-Kincaid grade levels of ChatGPT 3.5 Outputs vary between 18.3 and 21.7 and are similar to the Input text grade level (22.9), which means the text comprehension requires the competence of a college graduate.

Overall, the reading ease statistics comparison demonstrated that all ChatGPT outputs are more complex than the input in terms of their accessibility. It means that the AI model failed to produce the output according to the set parameters.

6.2.3. Iteration

Iteration appeared to be necessary based on the response to Prompt 1, where the output of the AI model under study did not match the user's expectations in terms of accessibility. Prompt 2 was designed for better clarity to ensure ChatGPT understands what aspects of the text need to be changed. It specified five amendments to be made: (1) text and (2) sentence length, (3) number of sentences and (4) number of words in those sentences, and (5) passive structures. These parameters were set based on the Flesch-Kincaid statistics tool. Apart from the list of required changes, Prompt 2 specified that the reading must be “simplified” instead of “adapted,” as in the case of *Prompt 1*. *Prompt 2* also asked ChatGPT to amend the text for the level of college students instead of any specific range on the Flesch-Kincaid scale.

Prompt 2: Can you please simplify the following text by changing text and sentence length, number of sentences and words comprising them, and passive structures to make it accessible for college students?

Table 5 below compares the input text statistics and the three received outputs by ChatGPT (ChatGPT, January 15, 2024).

The data in Table 5 demonstrates the results of three attempts of ChatGPT to simplify the text based on the five parameters mentioned in Prompt 2. The three outputs differ from each other in terms of text complexity only slightly. Flesch's reading ease score increased from 13 points in the Input text to 21 – 22 points in the Outputs. Flesch-Kincaid grade level of the output varies between 15.5 and 16.4 points. This means the texts adapted based on Prompt 2 became more accessible than the ones based on Prompt 1 where the variation ranged between grade level 21.7

Table 5. Comparison of readability of ChatGPT outputs on Flesch-Kincaid scale

Flesch-Kincaid Statistics	Input text	Output 2.1	Output 2.2	Output 2.3
Words	231	173	173	151
Sentences	5	8	8	6
Words per sentence	46.2	21.6	21.6	25.1
Passive sentences	40%	25%	0%	33.3%
Flesch reading ease	13	22	21	21.6
Flesch-Kincaid grade level	22.9	15.5	15.6	16.4

and 18.3. The increase in reading accessibility might be attributed to a considerable reduction in overall word count from 231 words in the Input text to 151 – 173 words in the Outputs, an increase in the number of sentences (6 – 8 sentences per text) with 21.6 – 25.1 words per sentence, and manipulation of passive sentences the number of which varied between 33.3% to 0% in the AI generated output. However, despite improved reading ease score and grade level of the texts in all the three outputs, the accessibility of the reading remains within the same range as the Input text: 0 – 30 points. Hence, the texts manipulated by ChatGPT can be described as “very difficult” and are accessible to college graduates.

The reading ease statistics comparison of the three outputs based on Prompt 2 demonstrated that neither of the ChatGPT manipulated texts improved accessibility to the desired level despite the provided amendment parameters.

7. Conclusions

The paper presented an exploratory study of the performance of ChatGPT in text adaptation for international undergraduate students. Several prompts were designed to investigate the reliability of the AI model in terms of text accessibility evaluation and reading manipulation based on a set of parameters chosen by the researcher. The study also aimed to identify the prospects of improving user experience, i.e., assisting educators with teaching materials design for a particular level of student competency.

The results of the research demonstrated the need to double-check AI-generated material. Relying on ChatGPT for reading adaptation should be done cautiously, especially regarding text complexity assessment and output readability.

Reliability in assessing the reading ease by ChatGPT is a concern. The AI model is inconsistent with its results. Upon output generation, it provides a range of different responses, from descriptive to numerical data. Moreover, there is a discrepancy between regenerated outputs that place the text within different levels of reading complexity. In addition, both descriptive and numeric outputs indicated a higher level of text accessibility compared to the actual Flesch-Kincaid statistics. This tendency could mislead users regarding the complexity of the text.

The model outputs do not match the parameters set in the prompt. The first attempt of the AI model to simplify the text resulted in a higher level of reading complexity despite the precise numerical input provided in Prompt 1. Specifying manipulation parameters and detailing the prompts did not result in the expected level of accessibility of the manipulated text either. Multiple regeneration of the output did not improve the quality of the product, and the overall accessibility remained within the same range as the input text.

Overall, the contribution of ChatGPT to the text amendment process for educational purposes is questionable due to the multiple gaps identified by the current research. Those gaps include a lack of ability to tailor the text to different levels of students or potential limitations in addressing specific text amendment parameters even though Flesch-Kincaid statistics is included in ChatGPT training. The study showed that the model may have challenges that make its effectiveness less reliable. The model's dependence on human input is high. However, even the detailed guidelines provided to ChatGPT in the framework of the current study did not succeed to the expected extent.

Human involvement is crucial for maintaining the quality of educational content. While ChatGPT may have advanced language capabilities, it may not fully grasp the nuances of educational material or the diverse needs of students. Humans should provide the necessary oversight to ensure the adapted text is accurate and aligned with predetermined parameters. This could involve educators or experts reviewing and refining the output generated by ChatGPT to meet the specific requirements of a given educational level.

The gaps identified by the current research indicate that further investigation is needed to fully understand the model's capabilities and limitations in application to text amendment. Additionally, recognizing the value of human participation highlights the cooperative role that AI and human expertise play in modifying educational materials.

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