The Use of Digital Annotation Tools in Improving Online Public Health Literacy among Youths

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ABSTRACT

Understanding public health materials is important to enhance public health literacy, as the lack of comprehension can have negative repercussions for individuals, society, and the healthcare system. It is essential for youths to grasp fundamental health information because it equips them with the knowledge and ability to address the intricate health needs and challenges of modern society. This study was conducted to assess the reading comprehension ability of youths when engaging with online public health materials in English, with a particular focus on diabetes. For this purpose, the research utilised Digital Annotation Tools (DAT) within an online reading system named Interactive Reading for Academic Disciplines (iREAD). Data were collected from a purposive sample of 30 students enrolled at a Malaysian public university. The students read 12 newspaper articles over the course of four weeks. Content analysis was conducted to analyse the annotations made by students while reading the articles. Both quantitative and qualitative approaches were employed to analyse the data. Analyses of the annotations indicate that students were able to paraphrase, summarise, synthesise, and contextualise ideas while engaging with the articles. The findings revealed that DAT has the potential to improve the understanding of online diabetes health education materials. This is a crucial development towards the increase in health knowledge and literacy as enhanced comprehension may, in turn, lead to increased health knowledge and empower individuals to make informed decisions about their health and well-being, ultimately contributing to higher levels of health literacy.

Keywords: health literacy; type 2 diabetes mellitus (T2DM); public health materials; digital annotation tools; annotation types

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INTRODUCTION

The youths are the primary focus of health literacy research and practice. Fundamental processes of cognitive, physical, and emotional development, as well as the development of skills and behaviours relevant to health, take place during the adolescence and youth. Adults have the cognitive abilities to comprehend and process information concerning a diabetes diagnosis, however children and adolescents can only comprehend and process medical explanations that correspond to their levels of development. Given the plethora of information accessible online, an evaluation of these materials is necessary as the way in which information is processed shifts from primitive, circular, concrete, and egocentric reasoning to more abstract and logical perspectives (Lipari, 2019).

Changes throughout adolescence and the drive towards independence can be difficult for adolescents and their families as they attempt to strike a balance between the look of normalcy and adhering to a condition that can be a considerable burden. Young individuals frequently seek to be "normal" and, consequently, forgo self-management behaviours to fit in with their peers (Christie, 2019). When their health, safety, and well-being are considered from the viewpoint of their developmental life course, young adults are at a higher risk of morbidity and mortality than adolescents and older adults in various profound ways. The ability of youths to master the necessary skills, particularly those pertaining to diabetes self-management and perception of public health materials in general, is a critical factor in determining whether they will be able to accept their condition and incorporate a new identity.

Diabetes mellitus type 2 (T2DM) is described as the most common type of diabetes in adults. As of 2019, 463 million individuals have been diagnosed with diabetes worldwide, and by 2045, that figure is expected to reach 700 million (Saeedi et al., 2019). According to Aznida Firzah et al. (2022), diabetes affects 18.3% of Malaysian adults, and pre-diabetes threatens 23.6%. The growing number of cases in Malaysia requires a greater emphasis on educating relevant parties about the importance of early detection and maximising resources for the proper management of individuals with diabetes. Healthcare professionals have for a long-time emphasised weight management and changing unhealthy lifestyles as means to manage T2DM (Saeedi et al., 2019). The success of patients who are at risk for or already have diabetes will depend highly on their awareness and treatment planning.

The Institute of Medicine (2004) defines health literacy as individuals' ability to obtain, process, and comprehend fundamental health information and services needed to make appropriate health decisions. Education about diabetes mellitus is an essential component of self-care, which includes lifestyle modifications, self-monitoring, and managing complex medication regimens. It is essential to develop educational materials that contribute to behavioural changes, improved adherence, and improved patient outcomes. Previous studies, including Lee and Kim (2022) who evaluated the readability of online public health materials, found that a significant proportion of the information was not written at a level that was easily accessible to the public. Lee and Kim (2002) concluded that the use of technical language and the lack of consideration for the target audience in developing online public health materials are significant contributors to low readability levels. Furthermore, the results of the study highlight the importance of ensuring that public health information is written in plain language and that it is designed to meet the needs and capabilities of the intended audience. Similarly, Bould and Forshaw (2022) found it significant for public health materials to be readable, enabling the public to process the information fluently. Therefore, it is necessary to evaluate the readability of online public health materials to suit the level of the readers, especially the youths.

Despite its importance, current studies on understanding or comprehension of internet health materials especially by youth is still inadequate. This includes the varied effects of

public health programmes on youths (Lipari, 2019) and the relationship between readability and engagement of public health materials which is an important component for comprehension (Bould & Forshaw, 2022). One marker in identifying comprehension of health information is using digital annotation tools (DAT). The present study examines how an integrated reading system called Interactive Reading for Academic Disciplines (henceforth, iREAD) assists the reading of English public health online materials by looking at the way annotation tools facilitate students' reading comprehension. The main purpose is to develop an understanding on the types of annotations youths made in attaining comprehension on health literacy when reading English public health materials in iREAD. It is critical that the general population be able to read and comprehend written materials regarding their health, especially when it relates to crucial public health issues such as diabetes.

Given that the consequences of interventions at this phase of life are likely to be long-lasting, efforts to address health disparities will need to consider the transitional experiences of youths. Essentially, youths are also young adults in higher education that are considered as a priority social group who will develop lifelong healthy behaviours (Alves, 2022). Although diabetic patient education resources are widely accessible, their efficacy is unknown (Bould & Forshaw, 2022; Hussein et al., 2015).

A developmental perspective can improve policies and initiatives to reduce the incidence and prevalence of disease and injury among young adults (Bednarek, 2019). It is essential to comprehend fundamental health information to make significant health decisions (Bould & Forshaw, 2022; Lee & Kim, 2022). Low levels of health literacy can negatively impact individuals, society, and the health care system; hence, it is crucial to interpret accurately public health information to improve health literacy (Worrall et al., 2020). Therefore, it is essential to conduct this study to identify the level of comprehension that youths have regarding online information related to public health to elevate the level of literacy regarding public health among young people. The article selection based on Malaysian Diabetes Corpus (MyDC) becomes a contributing factor in exploring the significance of online tools in assisting students to achieve comprehension in reading public health materials online (Hamat et al., 2022).

PUBLIC HEALTH MATERIALS

Readability is a scientific measurement of how easily written material can be read and comprehended. Materials with poor or low readability can impair a reader's capacity to access, absorb, and use health information. The readability level of online health information should be appropriate for the general audience. Readability is essential for information to be useful and increase care quality. Numerous online resources are readily available for the promotion of diabetes awareness and the initiation of treatment. It is imperative that such health-related information be written at a reading level comparable to that of an elementary school to ensure comprehension by the average adult Malaysian (Hamat et al., 2022). Public health materials are considered understandable when consumers can comprehend and explain key messages regardless of their background and degree of health literacy.

Poor readability of online public health materials can result in erroneous information and have a negative impact on health. Therefore, healthcare providers should advise patients on selecting online resources with legible and reliable information as there is no quality control on the internet. Additionally, governments and healthcare providers should be aware of the information provided in online sources and ensure the readability of sources is understood by all, as this will increase people's compliance with health guidelines. Youths including university students have also adopted a web-based health education programme to assist

students with the knowledge and strategies in making healthy decisions and adopting healthy behaviours (Alves, 2022).

Past studies, however, have indicated that the readability of online resources pertaining to public health is poor (e.g., Bould & Forshaw, 2022; Daraz et al., 2018; Worrall et al., 2020). Daraz et al. (2018), for instance, stated that the readability level of online health information in the United States and Canada is insufficient for public consumption. Similarly, Bould and Forshaw's study (2022) revealed that despite the recommended sixth grade reading level for public information, most of the evaluated websites that provided COVID-19 information and recommendations did not comply with this guideline. Based on these findings, many people intending to use the internet to help them make decisions about their health and behaviour will not be able to easily read and comprehend a large percentage of the material about COVID-19 that is available. The study also suggests that online information on public health overestimates the general population's reading proficiency and provides inaccurate information regarding alternative therapies.

In Malaysia, a reported 35% of Malaysian adults have low health literacy, raising concerns about the readability of health information for the general population (Hamat et al., 2022). The readability and content of online health information, therefore, must be enhanced. The present study examined how the comprehension of diabetes nutrition and health education materials among youths can be enhanced using digital annotation tools.

DIGITAL ANNOTATION TOOLS (DAT)

Electronic documents are becoming more available, increasing the need for electronic management such as annotation mechanisms because of their potential to enhance online reading. Digital Annotation Tools (DAT) provides a valuable resource for enhancing the understanding of online materials (Lai et al., 2020). These tools allow users to add notes, highlights, and perform other actions directly to online content, making it easier to keep track of important information and to actively engage with the material. Furthermore, DAT facilitates collaboration and discussion, enabling users to share annotations and insights with others, leading to increased engagement and comprehension of the material (Chen & Chen, 2019). The use of DAT also enables users to quickly revisit their annotations and notes, making it easier to recall important information and continue learning.

It is believed that annotation methods such as highlighting main ideas, underlining difficult words, or adding notes can also improve comprehension (Ruhil Amal et al., 2020). Using these annotation methods reduces the cognitive load of the reading process, promotes understanding by connecting information in a text, and enhances critical reading skills. Recent studies have shown that DAT can enhance understanding through better comprehension of annotated texts rather than those without annotations. Ruhil Amal et al. (2020) demonstrated that DAT-aided students' reading comprehension was facilitated in an online reading environment. The study involved 15 English as a Second Language (ESL) students reading scientific academic materials online.

A study conducted by Smith et al. (2021) found that the use of DAT significantly improved reading comprehension and retention of information. The participants who used DAT showed a significant increase in their understanding of the material compared to those who did not use these tools. Additionally, the participants who used DATs reported higher levels of engagement and motivation to learn. These results demonstrate the positive impacts of DAT on reading and learning outcomes and highlight their potential as a valuable educational resource.

THEORETICAL FRAMEWORK

This study was primarily guided by Schema Theory, a theory of how knowledge is acquired, processed, and retrieved and is a significant component of cognitive research. Cognitive scientists refer to this method of information processing, organisation, and storage as "schema" in technical terms. These cognitive constructs, known as schemas, are believed to play a role on how we arrange information in our long-term memory (Piaget, 1952). Schemata are consequently intricate networks of information that humans employ to make meaning of novel stimuli, events, and situations, and as such have been referred to as the fundamental components of cognition (Rumelhart, 1980). Schema encourages students to be more engaged in the reading process by guiding them from sensory thinking to imaginative thinking, thus promoting active participation in comprehending and understanding the material (An, 2013). According to Carrell and Eisterhold (1988), reading is related to schema theory and is a constructive and active process that requires readers to comprehend content by retrieving and using prior knowledge. To properly comprehend what they read, readers must tie the content of the text to their own knowledge. Hence, the ability to create mental representations based on the information read allows readers to make logical links between prior knowledge and new information retrieved. Karami (2020) indicated that unlike other theories such as sociocultural and information-processing, the application of schema theory is more suitable during the pre-reading stage. As such, schema theory is closely related to reading comprehension in iREAD as it provides a general idea how knowledge can be organised in an online environment.

Indeed, the theory has been used and applied in various fields including education. For example, Ahmed (2018) used schema theory to monitor the progression of students' comprehension pertaining to innovative notions, such as love. The outcomes revealed that the students' understanding was enhanced as they amalgamated common concepts to form a creative conception. In another study, Qi and Jiang (2021) used schema theory to assist research on the impact of graphic organisers on the sustainable development of English reading comprehension for EFL students with a moderate reading ability. More recently, Allison (2023) employed schema theory to aid students in comprehending textbooks and journal articles while enhancing their domain expertise.

METHODOLODY

The present study examined how an integrated reading system facilitated students' comprehension of online materials about public health. More specifically, it investigated how digital annotation tools (DAT) helped students understand the public health materials and what kind of annotations were made when students were engaged with the materials. This study utilised an online reading system named Interactive Reading for Academic Disciplines (iREAD) (Nor Fariza et al., 2014). The data and findings of the study were analysed using both quantitative and qualitative approaches.

PARTICIPANTS

The study employed the purposeful sampling technique which refers to a sample that is deliberately chosen to investigate the central concept being studied (Creswell & Plano, 2011). A sample of 30 students who were previously enrolled in English for Academic Communication from various science and technology courses at a Malaysian public university was selected for this study. Males and females of 21 to 23 years of age were equally represented. Each student gave an informed consent before participating in the study.

iREAD

Annotation data was acquired using the iREAD online reading platform. A team of experts from Universiti Kebangsaan Malaysia developed the system with various features such as DAT, discussion forums, video, and audio capabilities (Nor Fariza et al., 2014). While the system is composed of various tools, the study focuses on only one of them, the annotation tools, which contains two features. The first feature allows the students to highlight the online reading materials with various colours, such as red, green, and yellow, while the second feature enables students to write notes, comments, or other information about the highlighted texts.

ONLINE READING MATERIALS

The students were required to read three articles weekly over the course of four weeks. In total, the students read 12 articles. All 12 articles were featured in the online version of *The Star*, an English-language newspaper in Malaysia. The articles talk about health issues pertaining to diabetes. The 12 articles are listed in Table 1.

TABLE 1. List of articles

Week	Article title
1	Diabetes: Making the right choices (Fun & Lee, 2014)
	Living well with diabetes (Chee, 2015)
	Give me the honey! (Chung, 2013)
2	Life in the fasting lane (Ho, 2018)
	Eat right, move more (The nutrition month Malaysia 2014 steering committee, 2014)
	Diabetes and sleep deprivation feed on each other (Mann, 2014)
3	Important keys to healthy eating (Anonymous, 2017)
	Borderline sugar alert (Embong, 2013)
	The sweet crisis: dealing with diabetes (Siong, 2015)
4	Let's eat smartly (Balaratnam, 2013)
	Are we concerned about expanding waistlines in Malaysia? (Jegathesan, 2014)
	The role of food in preventing diabetes (Yassin & Appukutty, 2015)

Traditionally, many conventional formulas on readability were employed to readers from specific age groups using small corpora of texts taken from specific domain (Crossley, 2023). In this study, a specific domain corpus, i.e. Malaysian Diabetes Corpus (MyDC), from public health domain was used to assess reading among second language learners. MyDC is a specialised corpus build for public health domain specifically on diabetes issues developed by Hamat et al. (2022) to monitor linguistics trends of health newspaper articles for the term 'diabetes'. The corpus was extracted using the data from *The Star* newspaper articles from 2013 and 2018 (Hamat, et al. 2022). Initially the corpus has 212 articles, and 12 articles were selected based on the criteria including relevancy and number of words. The articles in the corpus were evaluated as suitable for public health guidance by a nutritionist and a public health expert which suits the need of the study (Hamat et al., 2022).

The selection of the articles was made based on the parameters set by using purposive sampling technique suggested by Creswell (2012). Purposive sampling, alternatively referred to as judgmental or selective sampling, is a method of non-random sampling employed to deliberately choose newspaper articles for research, guided by specified criteria or specific objectives. In contrast to the approach of random sampling, which seeks to achieve representativeness, purposive sampling is centred around the deliberate selection of articles that are deemed to be highly pertinent or instructive in relation to the study objectives. Firstly,

the articles are extracted based on contextual relevancy where they share the same variable of topic which is on health issue related to diabetes. Finally, the articles were extracted based on the availability and accessibility for the whole news report. Two or three most relevant articles for each year from 2013 and 2018 were suggested by the newspaper website (*The Star*).

Although students read 12 articles, this study examined only articles that required students to annotate the text being read. Nine of the 12 articles did not require students to annotate. Instead, the students were required to answer relevant questions in the online discussion forum. Since this study focused on annotation analysis, investigation was only conducted on three articles: 'Give Me the Honey!' (Chung, 2013), 'Diabetes and Sleep Deprivation Feed on Each Other' (Mann, 2014), and 'Are We Concerned about Expanding Waistlines in Malaysia?' (Jegathesan, 2014). These articles are emboldened in Table 1.

DATA COLLECTION PROCEDURES

Annotation data were collected during semester break over the course of four weeks. Three articles were posted weekly. Students read the materials online at their preferred time according to the weekly reading materials posted. They were required to complete several tasks given based on the reading materials posted. Such tasks included answering or discussing issues in the online discussion forums as well as annotating the reading materials that were being read. Annotation activities required students to highlight parts of the texts based on prompts provided. This also included adding in comments or ideas based on the texts that have been highlighted. To perform this task, students would select the element to be highlighted; apply the highlighted colour (red, green, or yellow); add comments to the highlighted text; and finally, click the save button. Figure 1 demonstrates all four steps in annotating texts in iREAD.
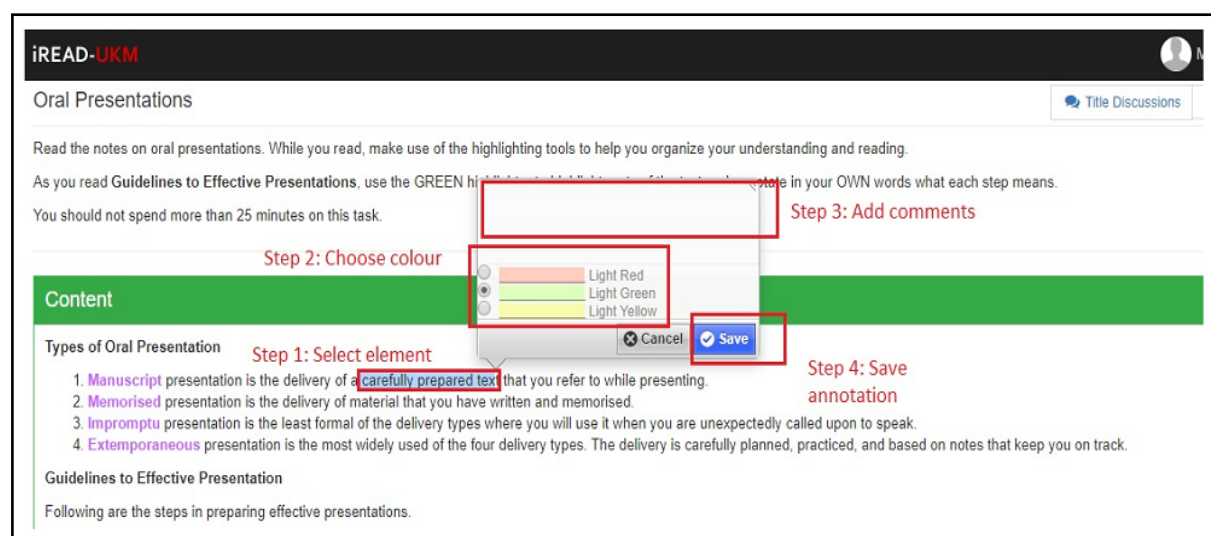
FIGURE 1. Annotation process

Each annotation is treated as a unit of analysis; thus, an annotation can either be a word, a sentence, or a paragraph as a form of content analysis (Marshall, 1997). These forms of annotations were made using the DAT in iREAD. The data based on each annotation made were tabulated and presented based on annotation categories created through content analysis created by Marshall (1997). The annotation based on the categories were then validated by two raters who were appointed based on their academic background in Teaching English as a Second Language (TESL) and over 20 years of teaching in universities. Further analysis on each annotation made is discussed next.

DATA ANALYSIS

The present study analysed the annotations made by the students based on two major elements: the highlighted texts and the annotation notes that students created based on the highlighted texts. The annotation notes that students created were any written texts that can be a rephrase or summary of the highlighted texts. These creations were based on prompts created in the instructions given to students before they start reading the texts. A sample of the instruction given to students can be seen in Figure 2. Hence, based on these annotations, categories were created to analyse each annotation made by students.

Categories developed by Marshall (1997) as cited in Tseng et al. (2015) was used to analyse annotations based on content analysis. The main category is *Minf* indicating marking information. *Minf* is classified into two forms: highlighted texts that characterise keywords or main ideas, and written notes that express a key term or rephrased ideas. In this way, different elements of the online text are indicated by different highlights. Based on the categories tabulated for the annotation notes, the rating process by the raters was conducted separately. A portion of the data from the annotation notes was cross-checked by two raters. The raters' agreement on the categories, their definitions and comments were noted. The researchers then discussed the disagreement and feedback and made modifications based on the suggestions. The amount of agreed and disagreed items from each rater was then gathered and calculated to obtain the kappa value. Cohen's kappa was used to calculate the probability of similarity between the raters. The kappa values were calculated and the average kappa value for the annotation notes was 0.81, indicating a strong level of agreement between the raters (McHugh, 2012). This indicated that the data analysis on the annotation notes was of high reliability. These data were then presented as numerical data and elaboration of annotation notes is presented in the next section.

RESULTS AND DISCUSSION

Although data were collected from 30 students, the findings of this study highlighted the annotation types made by 15 students who completed all the tasks given to them. The remaining 15 students did not complete the tasks given, rendering their data incomplete. As described earlier, highlighted texts indicate marking information using the highlighted colours such as green, yellow and red. Annotation notes refer to any written ideas made by students. This can refer to paraphrased ideas, summaries, or restatement of information. Figure 2 is a screenshot of the first activity for the article entitled 'Give Me the Honey!'.
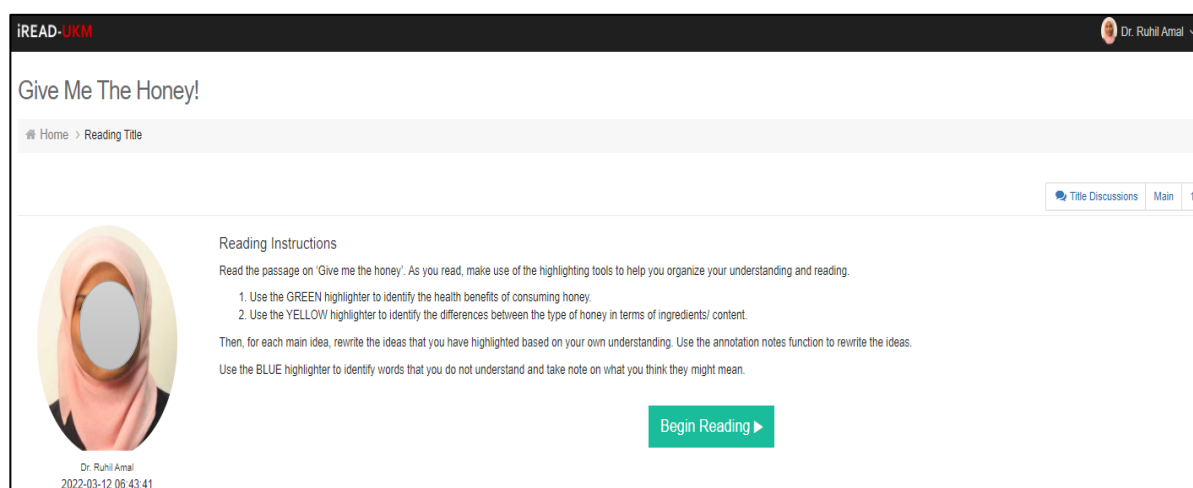
FIGURE 2. Instructions on 'Give Me the Honey!'

For the first activity, students were required to use the green highlighter to identify the benefits of consuming honey. They were also required to use the yellow highlighter to identify the differences between the types of honey in terms of ingredients or content. Table 2 summarises students' annotations on the first article 'Give Me the Honey'.

TABLE 2. Summary of annotations on 'Give Me the Honey!'

No	Student	Highlighted text (*Minf*)	Annotation notes (*Minf*)
1	Student YS*	9	0
2	Student PJ	16	0
3	Student SJ	11	8
4	Student KM	16	0
5	Student NI	34	22
6	Student FA	8	9
7	Student AM	19	11
8	Student MF	9	9
9	Student CN	11	6
10	Student AS	12	13
11	Student JY	19	16
12	Student NA	11	1
13	Student IF	31	6
14	Student NH	8	8
15	Student NS	9	9
	Total	223	118

* Acronyms, e.g. YS and PJ, used to facilitate data organisation while concurrently ensuring the participants' anonymity

In total, students made 223 highlighted texts, out of which, 118 consists of written notes. This indicated that 53% of the written notes were students' reproduction of texts read based on understanding. This shows that students understood the materials they were reading and were able to relate it to their background knowledge, which is complementary to Schema Theory (Carrell et al., 1988). Samples of annotation notes, which are considered as restatement of ideas for this activity are shared in Figure 3.

FIGURE 3. Annotation samples for 'Give Me the Honey!' by Students NI and MF

It can be seen from Figure 3 that Student NI made a statement of opinion based on the article read, i.e. *According to a study, honey may be able to fight cancer and prevent the spread of cells*. There was no indication of relating the text read to any background knowledge. However, Student MF was able to paraphrase the idea that there are different effects of honey on blood glucose level, i.e. *From this sentence, I understand that each type of honey that we consume will have a different effect on our blood glucose level. This might be because of the difference in terms of the content of the honey itself*. The student was then able to describe further that the content of the honey can cause this. This indicated that Student MF was able to understand the article and related it to schemata.

FIGURE 4. Annotation samples for 'Give Me the Honey' by Students FA and AS

Figure 4 shows several annotations made by students on the same article. Based on the annotations made by Student FA, there is a clear indication that the student was able to summarise the idea that there is a need for diabetics to consume honey with lower Glycaemic Index (GI). The annotation made is: *Honey are proven to have antimetastatic, antiproliferative, and anticancer effects…can prevent the cancer cells to spread widely and good to be used as treatment of cancer*. This indicated that even with difficult terminologies, the student could grasp the meaning of the text. In a similar study, participants showed an increased understanding and retention of information using DATs (Smith et al., 2021).

In week 2, students were required to read an article entitled 'Diabetes and Sleep Deprivation Feed on Each Other'. This article provided information on how diabetes symptoms disturb sleep, and how sleep loss contributes to diabetes. As students read the article, they were required to rewrite the ideas highlighted based on understanding. The annotation activity instruction is depicted in Figure 5.
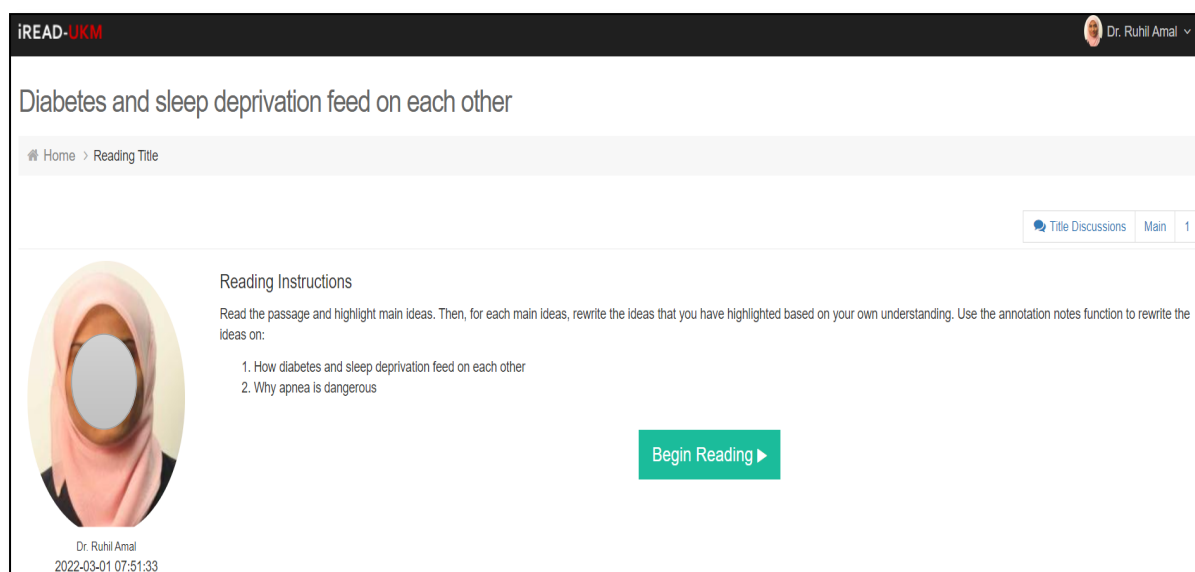
FIGURE 5. Instructions on 'Diabetes and Sleep Deprivation Feed on Each Other'

As seen in Figure 5, students were required to highlight and rewrite the main ideas based on understanding, particularly those related to how diabetes and sleep deprivation feed on each other and why apnoea is dangerous. Table 3 is a summary of the annotation activity completed by the students.

TABLE 3. Summary of annotations on 'Diabetes and Sleep Deprivation Feed on Each Other'

No	Student	Highlighted text (*Minf*)	Annotation notes (*Minf*)
1	Student YS	11	6
2	Student PJ	11	0
3	Student SJ	10	7
4	Student KM	5	5
5	Student NI	14	10
6	Student FA	6	6
7	Student AM	13	6
8	Student MF	4	4
9	Student CN	7	4
10	Student AS	4	4
11	Student JY	10	9
12	Student NA	6	2
13	Student IF	12	3
14	Student NH	3	3
15	Student NS	4	4
	Total	120	73

A total of 120 highlighted texts were made by students, and 73 consisted of additional written notes. This suggests that the students understood the texts and could reproduce the main idea based on their linguistic knowledge. Similarly, Ruhil Amal et al. (2020) found more than 54% of students' annotation notes were based on reproduction of main idea, indicating students' cognitive knowledge to comprehend and process information. Figure 6 shows samples of the annotation notes.

FIGURE 6. Annotation samples on 'Diabetes and Sleep Deprivation Feed on Each Other' by Students FA, NA and AS

Annotation made by Student FA, i.e. *CA is other type of sleep apnoea that also cause breathing to stop but is longer period of time,* indicated the student's ability to paraphrase ideas. The student received the information on Central Sleep Apnoea (CSA) and described what it entails using his own words. This statement suggests that understanding or cognitive schema has changed with the new information received. Such new information provided students with the necessary knowledge and strategies that will allow them to make healthy decisions and lifestyles (Alves, 2022). Furthermore, Student NS was able to highlight the difficulties caused by diabetes by restating the complications such as sleep deprivation which leads to the worsening of health conditions, i.e., *Diabetes difficulties such as the syndromes can lead to diabetics getting lesser good sleep causing their health state to worsen.* At the same time, Student AS was able to identify the dangers of apnoea, i.e., *Apnoea is dangerous because it affects the amount of oxygen to be delivered to our main organs.* The student was able to restate

this in her own words by describing how the reduction of oxygen sent to the body can affect the brain and heart.

The third annotation activity which was completed in the fourth week involved reading of an article entitled 'Are We Concerned about Expanding Waistlines in Malaysia?'. Refer to Figure 7 for the instructions on this activity.
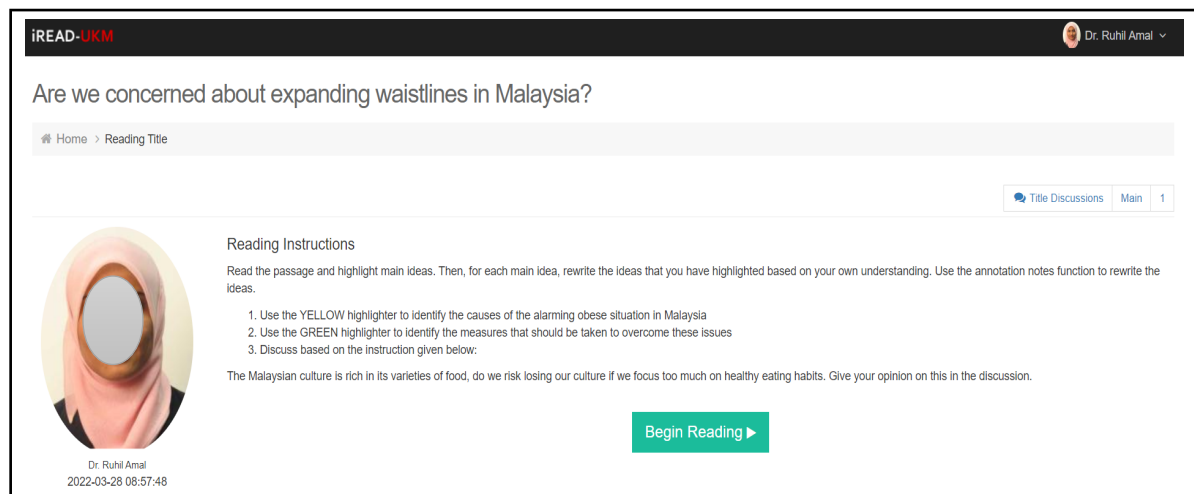

FIGURE 7. Instructions on 'Are We Concerned about Expanding Our Waistlines in Malaysia?'

As seen in Figure 7, students were required to use the yellow highlighter to identify the causes of obesity in Malaysia and the green highlighter to identify the measures that should be taken to overcome these issues. They were then required to rewrite the new knowledge obtained based on their understanding of the article. Table 4 summarises the annotations made by students for this activity.

TABLE 4. Summary of annotations on 'Are We Concerned about Expanding Our Waistlines in Malaysia?'

No	Student	Highlighted text (*Minf*)	Annotation notes (*Minf*)
1	Student YS	5	0
2	Student PJ	9	0
3	Student SJ	6	6
4	Student KM	11	0
5	Student NI	11	0
6	Student FA	8	0
7	Student AM	10	0
8	Student MF	4	4
9	Student CN	6	5
10	Student AS	7	7
11	Student JY	10	0
12	Student NA	7	0
13	Student IF	14	0
14	Student NH	6	7
15	Student NS	7	4
	Total	121	33

In total, students made 121 highlighted texts, out of which only 33 consisted of written notes. This suggests that the written notes were students' reproduction of texts based on understanding. Figure 8 includes samples of annotations made by students for this activity.

FIGURE 8. Annotation samples on 'Are We Concerned about Expanding Waistlines in Malaysia?'
by Students MF, SJ, and CN

As evident from his annotation in Figure 8, i.e., *action such as reducing sugar content and cooking oil in all food should be taken seriously to reduce the obesity rate in Malaysia*, Student MF was able to summarise the need to reduce sugar content and oil in all food to reduce obesity in Malaysia. This included building more parks to encourage exercise. It is a clear indication that student MF was able to comprehend the health information provided related to risk of obesity. Understanding health information is an important component in health literacy. The ability to understand written health information is important to raise awareness and optimising the management of patients with diabetes in the future (Aznida Firzah et al., 2022).

The article also raised public awareness regarding the government's initiatives and actions to address the issue of diabetes. Student SJ, for instance, stated the need *to reduce the subsidy of sugar and cooking oil* in Malaysia. Similarly, Student CN made note of the government's efforts *to assert awareness and encourage healthy lifestyle* among Malaysians.

The findings of this study have demonstrated that the students who read online resources using DAT can paraphrase sections to attain comprehension. The application of DAT appears to enhance the students' understanding of the contents of public health materials. The highlighting feature in DAT enables students to focus on reading while still actively annotate reading materials. As suggested in schema theory (Piaget, 1952), highlighting texts greatly enhances reading because it indicates vital areas, aids in recall information, and works as visual signals. This indicates the ability to connect ideas, concepts and information when navigating English online reading materials in iREAD (Ruhil et al., 2017). It has been proven that important phrases, words, and sentences that are highlighted are easier to comprehend compared to those that are not highlighted. The annotations can also be viewed as an additional layer of information to existing offline resources, such as class discussions with the lecturer and other students.

CONCLUSION

This study set out to determine the significance of DAT in alleviating health literacy among youths in Malaysia. The findings of this study show that DAT aids the youths' understanding of and interaction with public health materials because it facilitates the process of highlighting, editing, and adding notes in electronic form without modifying the resources. This was illustrated through instances derived from annotations, in which students could paraphrase main ideas, summarise information, and improve comprehension of the public health materials.

These findings are significant particularly in relation to diabetes self-management and knowledge of public health materials in general. Understanding the content of health materials is a pre-requisite to making informed decisions and taking proper action for one's health management. Individuals who can understand and use the information for their health benefits have better health literacy (Wittink & Oosterhaven, 2018). The evidence from this study suggests that youths just like their older counterparts, can assert control over their health and well-being by acquiring skills that are essential in comprehending health information. These skills provide them with the knowledge they need to communicate with healthcare providers confidently, make informed decisions about their own health, and advocate for themselves and those around them in medical settings. Taken together, these results suggest that it also helps in addressing public health challenges and promoting healthy habits that can have long-lasting positive impacts.

The scope of the study was limited to a small number of students in one university. Further research is needed to understand the level of public health literacy and promote it at a larger scale. The adolescence's health and well-being can be improved both during and after adolescence if policy and practice are based on an integrated understanding of this unique developmental stage. The primary finding of this study is that incorporating a developmental perspective into public health policies, initiatives, and healthcare provision can equally benefit the youths' health and well-being.

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