**Facilitating Online Reading Comprehension in Enhanced Learning Environment
Using Digital Annotation Tools**

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Abstract

The use of technology has now become an integral part of higher education in Malaysia because of its positive outcomes in teaching and learning. Despite its use, students are not able to fully benefit from its full potential. This study investigated the use of digital annotation tools in Interactive Reading for Academic Disciplines to facilitate reading of English for Science and Technology materials in a blended course among university students. Data were collected from 12 students enrolled in English for Technical Communication in a public university on the East Coast of Peninsular Malaysia. Data collection consisted of online annotations and focus group interviews. Analysis was descriptive and thematic, using SPSS and NVivo software, respectively. Inter-rater reliability analysis was measured using Cohen Kappa reliability analysis that yielded an almost perfect score, proving that the data were reliable. The findings revealed that digital annotation tools facilitated reading comprehension among students in an online reading environment. Annotation analyses revealed consistency in interview data when students were able to paraphrase, extend and synthesize ideas. An implication from this study suggests that training students' regarding strategies on how to deal with annotation tasks should be mandatory. This is integral for students to achieve comprehension of English for Science and Technology materials in an online environment.

Keywords: digital annotation tools, online reading, English for specific purposes, English for science and technology

Online materials have now become one of the main sources of knowledge for students, especially in academic settings. With the spread of digital educational spaces such as blogs, Online Discussion Forums (ODF), Wikis and Learning Management Systems (LMS), there is a rising demand for materials that can be read in digital formats. Within this context, it is the educator's role to equip students to read online and explore online features so that they can make the most of the myriad of online resources (Gilbert, 2017) and also to enhance learner autonomy. If students are not well equipped, they will face challenges reading online because the materials change and distract readers with multimodal features (Cho & Afflerbach, 2017). Hence, teaching students how to read effectively online is crucial as library materials have been digitized to create e-books and online articles.

Research on online reading comprehension is expanding from traditional comprehension models to include "the purposes that drive online reading, communicative outcomes of online reading, and the continuously changing nature of the strategies, skills and dispositions that are required during online reading comprehension" (Leu Zawilinski, Castek, Banerjee, Housand, Liu & O'Neil, 2007, p.5). Moreover, according to Murugaiah (2016), a number of Computer-Assisted Language Learning (CALL) technologies (for example electronic dictionaries and multimedia annotations) are commonly employed in teaching and learning as they provide assistance for learners in various ways. For example, there is a belief that using various online annotation types is a good, supportive reading strategy for learners (Thoms & Poole, 2017). Huang (2014) conducted a study to examine the effectiveness of online versus paper-based reading strategy instruction on EFL learners' reading comprehension on fifty-seven students. The result revealed that the second most positive feedback was that the online highlighting function of the annotation tool facilitated incidental vocabulary learning because the colour-coded highlight function helped students tracked the parts that require attention. They also used the highlighting function to re-read for understanding. Ridder (2002, as cited in Huang, 2014) reported that the highlighted or visible hyperlinks increase students' willingness to consult electronic dictionaries. In some cases, annotations or dictionary definitions are available for students but these are not readily accessible and students cannot use these tools to their full potential. Herold (2014) contends that students need to work with the online tools, which are very useful, to learn at the highest level. Such online tools that can assist students in learning include Digital Annotation Tools (DAT). Hence, to understand ways in which DAT facilitate teaching and learning, this study addressed the following research questions:

1. What are the types of annotations made by students in Interactive Reading for Academic Disciplines (iREAD)?
2. How do annotation tools facilitate students reading of English for Science and Technology (EST) online materials?

Previous studies have concentrated on the effectiveness of annotations on reading comprehension. Some of these studies have concentrated on the use of annotations but have failed to delineate the actual process involved in using annotations to assist students to reach higher reading comprehension levels (Tseng, Yeh & Yang, 2015). However, far too little attention has been paid to the importance of annotations in teaching and learning. There is still much uncertainty that exists about the relation between annotation types and online reading comprehension. If teachers are not able to identify exactly which annotation types are useful for reading comprehension, they will not be able to determine reading instructions to promote students' comprehension levels. Thus, information obtained from what Malaysian English as a Second Language (ESL) university students do while reading EST online materials would contribute to the pedagogical aspect of English for Specific Purposes (ESP). This paper begins

with a literature review related to the study, then describes the methodology used, presents the results, provides a discussion of these, and lastly draws conclusions.

Literature Review

Theoretical Discussion

One reading model that is important in the current study is the Interactive Reading Model (Rumelhart, 1977). According to Rumelhart (1977), reading combines both bottom-up and top-down processes. Interactive models recognize the simultaneous interaction of lower level processing skills and higher-level cognitive skills. According to Duke and Pearson (2002), when it comes to comprehension, visual representation will help students understand, organize and remember. For example, highlighting information in a text is a supportive reading strategy as it allows readers to remember what they read and extract important elements. Thus, some elements of annotations conform to reading comprehension theories because these elements provide interactive reading opportunities that help students identify the key elements of paragraphs (Lo, Yeh & Seng, 2013). The key elements in the interactive reading model are important in the current study as students interact with texts by identifying parts of online reading materials through the use of DAT.

Previous studies report students' reading comprehension and their recall of information are based on a student's ability to recognize organizational structures (Lo et al., 2013, Gilbert, 2017; Ruhil Amal, Nor Fariza & Afendi, 2018). The ability to recognize organizational structures allows students to create a mental representation of the information and to see the logical links made by the author. Good readers can use text structures to retrieve the main ideas and to help them memorize propositions gained from reading. There is a large volume of published studies describing the role of teaching text structures to students (Duke & Pearson, 2002; Moss, 2004; Pardo, 2004). What is not yet clear is the impact of the types of annotations that students make in identifying text structures in achieving comprehension. This indicates a need to understand the various ways that DAT assist students in learning.

Blended Learning in Higher Institutions

The popularity of blended learning is increasing because it integrates online technology such as learning management systems and platforms, making learning more interactive. Previous studies recorded higher achievements and better attitudes toward learning when the effectiveness of blended learning was compared to conventional teaching approaches (Thang, Wong, Noorizah, Rosniah, Najihah & Kemboja, 2012). Educators use blended learning as an approach to teaching because of its potential to maximize learning and create a more efficient learning environment. For example, blended learning is believed to increase communication skills (Wang, Wooa & Zhao, 2009), improve critical thinking skills (Güzer & Caner, 2014), and to support collaborative learning (Haryani, Wan Faezah & Nor Aini, 2012). In Malaysia, 50% of courses in higher institutions offer online courses because it is an effective means to communicate within the teaching and learning context in the current era (Norazah, Mohamed Amin & Zaidan, 2011). Taken together, these studies reflect the benefits and need to incorporate blended learning in tertiary education contexts.

For example, in a blended learning English as a Foreign Language (EFL) environment, Lo et al. (2013) proposed an interactive approach in learning paragraph structure through the use of an online annotation system, *Paragraph Annotator*. Paragraph Annotator includes three highlight buttons; yellow for topic sentence, blue for controlling idea, and green for supporting details. These functions allow readers to analyze paragraphs and use annotation tools to add

personal ideas. Both a Cued Recall Test and a Free Recall Test were used to assess students' comprehension between experimental and controlled groups. The results revealed significantly better performance in both tests. However, the author overlooks the fact that annotation types contribute to performance. The results of this study suggest that online annotation technology provides EFL students with a flexibility to interact with the text that would not be accomplished in reading books alone.

Online Reading

With the development of technology, reading has shifted to using non-traditional media such as reading information on the world wide web in the form of videos, pictures, sounds, animations and hyperlinks known as online reading (Sung, Wu, Chen & Chang, 2015). According to Sung et al. (2015), reading online often creates a "hypertextual" form of reading that consists of nodes and hyperlinks. Reading this type of information requires the information to be read according to the order of the nodes. Even though hypertexts are considered to be non-linear, many still read them in a linear mode, merely transferring offline reading skills to online reading. This concept has recently been challenged by Kiili & Leu (2019) who believe in the complexity of the online reading and the challenges students face especially in collaborative online reading. There are specific strategies that are more appropriate for online reading.

However, there are various strategies used to manage online information and to navigate successfully by selecting links that are useful. This ability is required for successful online reading as it allows the reader to understand and construct potential meanings (Ruhil Amal et al., 2018). As proposed by Cho and Afflerbach (2017), there are three levels of building coherence in online reading: information comprehension; intertextual connection; and construction of reading paths. The first online reading strategy is related to traditional reading strategies such as infering, analyzing text information, and evaluating whether the text fulfills the reading objectives. The second online reading strategy, intertextual connection, refers to synthesizing multiple online sources that require multiple-text linking strategies to critically compare, evaluate, and corroborate the information found in diverse documents, to identify differences between sources, and to integrate content from different sources. The third strategy (construction of reading paths) refers to the construction of meaning through networked information technology that requires careful evaluation and selection of links. What is not clear is the impact of DAT on reading comprehension.

Digital Annotation Tools

More and more materials are becoming available as electronic documents, increasing the need for mechanisms that allow online annotations because annotation mechanisms have the potential to enhance reading online (Chiu-Jung & Pei-Lin, 2012). Annotation mechanisms such as EDUCOSM (Nokelainen, Kurhila, Miettinen & Tirri, 2003) and PAMS (Su, Yang, Hwang & Zhang, 2010), allow students to annotate the same documents, and share and provide feedback on the annotations (Tseng et al., 2015) to improve their reading comprehension. Several researchers contend that annotation methods such as underlining unfamiliar vocabulary, marking main ideas or key words, or adding notes for reflection improves reading comprehension (Marshall, 1997). These annotation methods minimize the cognitive load of the reading process (Chun & Payne, 2004), encourage understanding by connecting information in a text (Abuseileek, 2012), and improve critical reading skills (Johnson, Archibald & Tenenbaum, 2010). Annotation methods also provide interactive reading opportunities to identify key elements of paragraphs (Lo et al., 2013). Taken together, these are important processes in reading academic online materials.

Recent studies point out the importance of DAT to enhance teaching and learning because annotated texts allow for better comprehension in comparison to those without annotations (Chen, Hwang, & Wang 2012). For example, annotation software such as RedPencil encouraged students to be involved in their learning activities (Ahern, 2005). Students can easily use RedPencil to submit assignments and to view others' annotations or comments. It is not surprising that annotations can help students' comprehension in various ways. Despite this, much uncertainty still exists about the relation between annotation types and comprehension. In another study of an annotation technology called HyLighter, social annotation was examined. This study found students exhibited more critical-thinking skills than metacognition and comprehension skills when working in groups compared to working individually (Johnson et al., 2010). The study concluded that annotation, reflection and highlighting will not have a significant impact if conducted alone.

The ability to highlight the main points becomes an important reading strategy that guides students to achieve overall understanding of the online materials. Highlighting texts support reading because of three reasons as hypothesized by Li, Tseng & Chen. (2016). Firstly, highlighting is an encoding process that identifies key parts of a text. Secondly, highlighting texts captures readers' attention because they are able to recall texts easily compared to texts that are not highlighted. Lastly, highlighting texts acts as visual signals that allow retrieval of critical points during a reviewing process. Thus, annotations such as highlighting texts help learners monitor their understanding of the text as they decipher the L2 reading (Thoms & Poole, 2017). Together, these studies provide important insights into the need to utilize DAT to assist with the reading of online academic texts.

Methodology

The focus of the current study was to explore processes involved in reading EST materials in an online environment. This was conducted in an ESP course named English for Technical Communication (ETC) that utilized DAT in an online reading platform named Interactive Reading for Academic Disciplines (iREAD) for teaching and learning. Hence, a mixed method approach was used as the research design because descriptive statistical data from students' use of DAT were used to support the data gained from the focus group interviews.

Participants

The study adopted a purposeful sampling method to obtain rich data. Purposeful sampling refers to intentionally selecting a sample that explores the main concept being studied (Creswell & Plano 2011). Hence, a sample of 55 students from 614 students enrolled in English for Technical Communication from various Science and Technology courses for Semester 1, 2016/17 were selected. Twelve students were then selected to be a part of the qualitative data collection. There was an equal number of male and female students aged between 21 and 23 years old. All the students were taking the same English course; a compulsory level 2 English course at the university. Each student was provided a consent form to be a part of the study. The course is a blended course, where students met twice weekly for 2-hours tutorial and 2-hours computer labs. Students were participating because they had to for this class. However, during the initial briefing, students were briefed on the research project and were given options to move to other classes if they do not wish to participate. This is to ensure that they know their involvement is entirely voluntary and there are no repercussions for them not getting involved.

Instruments

Focus Group Interview protocols. One of the instruments used to collect data was through Focus Group Interview (FGI) protocols. The objective was to collect a shared understanding that focused on the current study and to generate data from the group. The interview protocol was designed to gauge the opinions of students about the use of DAT in iREAD. The questions were created by the researcher, which were then verified by experts in the field. The FGI protocol consists of questions related to the use of DAT such as highlighting and writing down annotation notes.

Online reading system: iREAD. An online reading platform called the Interactive Reading for Academic Disciplines (iREAD) was used to obtain annotation data. The system was developed by Universiti Kebangsaan Malaysia experts (Nor Fariza, Afendi, Hazita, Noorizah & Vengadasamy, 2014) with various functionalities such as DAT, discussion forums, video and audio features. Although the system consists of various online tools, the current study highlights just one of the main features, the annotation tools. The annotation tools in iREAD contain two features. The first feature allows students to highlight online reading materials with various colours such as yellow, red and green. The second feature allows students to write notes, comments or information about the texts that were highlighted.

Online reading materials. Text selection was based on an ETC module utilized by students during the semester. Each text was analyzed according to the Flesch Kincaid Readability Index that generates the level of difficulty of the reading texts. This allows the researcher to determine the suitability of the texts according to the students' proficiency level. Table 1 summarizes the topics covered during the two weeks.

Table 1: Topics in English for Technical Communication

Week	Topic	Flesch reading ease
5	Process Explanations: How to use a compass	63.9 – Standard/ average
6	Directional Process: At the factory, from bean to bar	54.9 – Fairly difficult to read

In Week 5, the lesson required students to read a 397-word essay about how to use a compass. The essay is written in a technical description format that consists of the vital elements (i.e main parts, dimensions) required in a complete write up. The essay consists of four paragraphs describing how to use a compass and how compasses work. The readability index for this essay was 63.9 – making it standard or average difficulty. The idea of selecting an average readability text was to introduce a more difficult text in the following week. Hence, in Week 6, students were required to read an essay entitled "At the factory: from bean to bar" with a readability index of 54.9, which was fairly difficult to read. Here, students were required to highlight and summarize in their own words the process of making chocolates.

Data Collection Procedures

Annotation data were collected in Week 5 and 6 during a 14-week semester. For the annotation activities, students were required to highlight parts of the text and then rewrite in their own words what each highlighted text meant. This involved four steps in using the digital annotation tools: selecting the element to be highlighted; applying the corresponding highlighted color (yellow, green or red); adding comments to the highlighted text; and, clicking the save button. At the same time, students were encouraged to use red highlighter to identify the topic sentence,

yellow to identify central ideas and green for supporting details. However, not all students used the colored highlighter accordingly. Figure 1 labels the process for using the digital annotation tools.
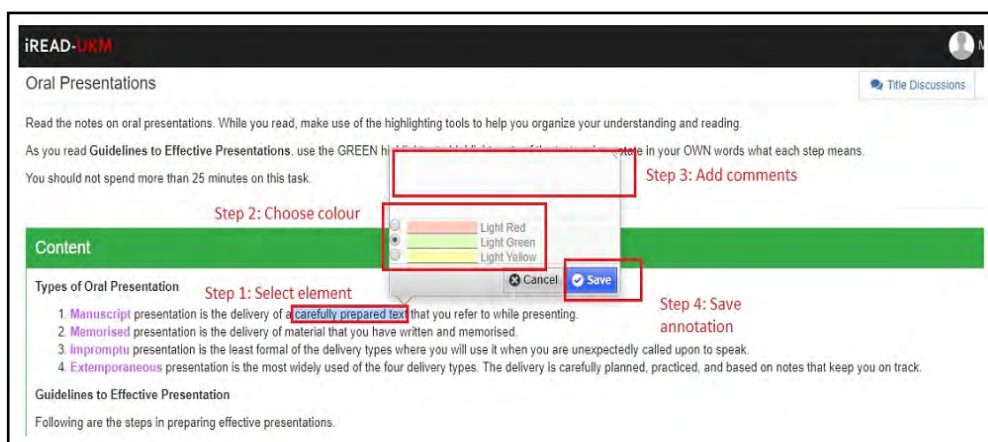

Figure 1: Screenshot of annotation process

Each annotation consists of either a word, a sentence-length, or a paragraph, which were made using the DAT in iREAD, where each annotation was considered to be a unit of analysis. The data were tabulated and described according to the themes created and illustrated in the findings. FGI was conducted in Week 7, after the students completed activities related to Technical Descriptions and Process Explanations. FGIs were conducted in two groups with 6 students in each group. The focus of the interview was to reflect on the use of DAT to facilitate reading of EST online materials while completing the activities in iREAD. Data were analyzed thematically.

Data Analysis
The study analyzed annotations using content analysis based on categories adapted from Marshall (1997) as cited in Tseng et al. (2015) where *Minf* refers to marking information. Two forms of *Minf* were categorized by the researcher as highlighted texts that identify keywords or main ideas, and written notes that are rephrases of a keyword or main idea and summarized ideas. The second type of annotations were *Mvoc,* which refers to marking vocabulary. Thus, two different highlights identify different elements of the online text.

The FGI data were analysed using the six steps proposed by Creswell (2014), which includes preparing and organizing the data, exploration of data through coding, creating themes, representing themes through narratives, interpreting the results and, validating the accuracy of findings. Data were validated using Cohen Kappa inter rater reliability analysis based on the developed themes. The calculation yielded a K value of 0.7, which indicated a substantial agreement, showing that the data analysis had a high reliability.

Results

In order to understand types and ways annotation tools facilitated reading of EST online materials, data are described thematically under two headings: identify paragraph structure, and improve understanding. The data described are gained from FGI and annotations made by students.

Identify paragraph structure

The following section discusses the use of iREAD's annotation tools in identifying paragraph structure when reading "How to use a compass". The data are presented in the form of interview excerpts (as depicted in words and phrases which are in bold) as well as a tabular format through the activities students completed. The researcher highlighted the bold words that identify the important points stated by students during the interviews. Students believe that annotation tools assist them in identifying paragraph structure when reading a text. The interview excerpts in Table 2 demonstrate this point.

Table 2: Interview excerpts 1

Student	Interview excerpts
Student L	We can know the passage flow and also we can **know how many main parts, how many sub-parts** according to the body. The body and the parts
Student S	Let's say when we highlight, we can know **what the paragraph is about** like this part we can talk about **body then we can know the sub-part**. This paragraph is talked about **body part, the function, dimension or description** to us. I can know my reading progress
Student V	**I can highlight the main idea, sub parts, main parts to let me recall back what I have read.** Oh, this is what source of description is. This is that and all that.
Student C	We do the activity for the technical description. So we want to know that which part you want to highlight first. For example, you want to **know the size, the material, the colour**, so we will focus on that

The interview excerpts in Table 2 are students' claims that annotation tools assist them in identifying parts of a paragraph structure such as "main parts", "sub-parts", "dimension", "description" and "color" in understanding a technical description. In view of this, online annotations made by students were analyzed in order to validate students' ability to recognize paragraph structure of a technical description as claimed by students in the interviews. The annotation activity that was explored was based on the lesson in Week 5 (see Table 1). For this particular activity, none of the students highlighted texts on vocabulary *(Mvoc)*. Table 3 summarizes the types of annotations made by students.

Table 3: Summary of annotations on Process Explanations

No	Student	Highlighted text *(Minf)*	Written notes *(Minf)*
1	Student E	9	6
2	Student T	8	8
3	Student L	4	4
4	Student G	8	8
5	Student S	0	0
6	Student K	4	4
7	Student V	7	7
8	Student J	1	1
9	Student C	6	6
10	Student R	9	8
11	Student H	4	4
12	Student A	6	0
	Total	**66**	**56**

Based on Table 3, all of the annotations made by students were content-based annotations (*Minf*). This means all annotations highlighted and written were identification of paragraph structure. There were 85% of written notes and only 15% were highlighted texts. This denotes students were able to identify parts of a technical description. The following screenshots are examples illustrating annotations made by students in identifying parts of a paragraph structure.

As shown in Figure 2, Student V was able to annotate parts of a paragraph structure. First, Student V identified 'orientation of parts' as a key component in the introduction of a technical description. Then, Student V identified "1st step" as part of how to use the compass. The other annotations were also "2nd step" and "3rd step". Student V was able to annotate 7 parts of a paragraph structure (see Table 3). These annotations are consistent with her claims in interview excerpt: *I can highlight the **main idea, sub parts, main parts** to let me recall back what I have read.* The bold words identify the important points stated by students during the interview.

Annotation No. 1:
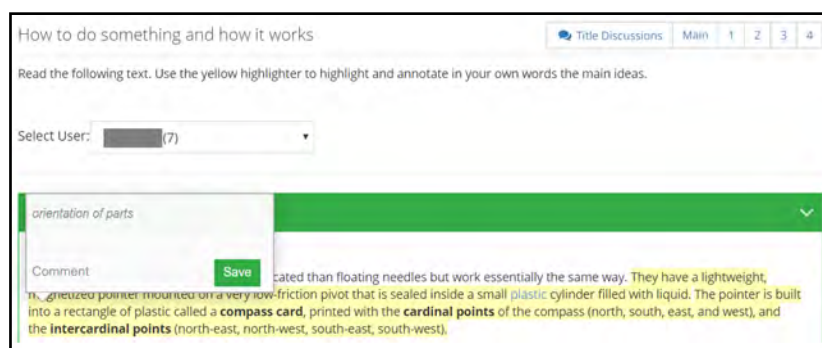
Annotation No. 2:
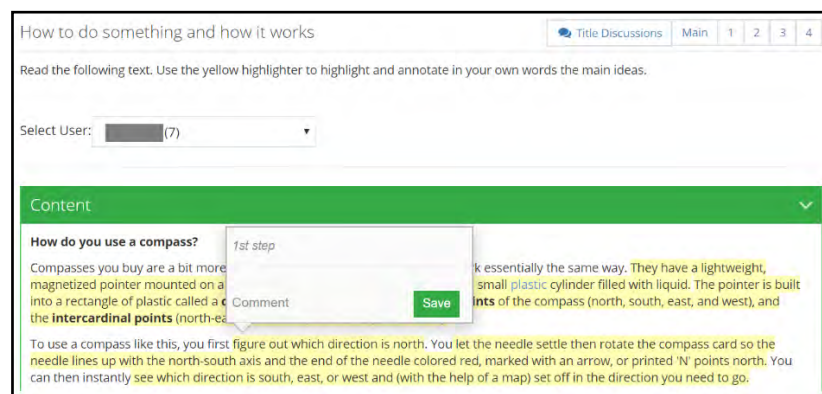
Figure 2: Screenshot of annotation No. 1 and 2 by Student V

Figure 3 demonstrates three examples in identification of paragraph structure by Student C.

Annotation No. 1:
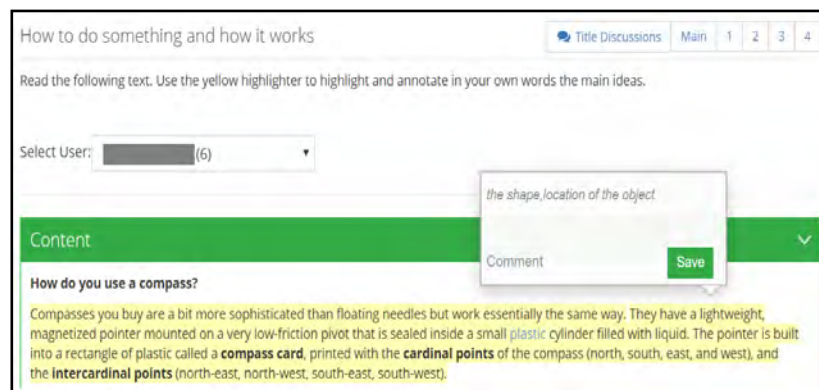
Annotation No. 2:
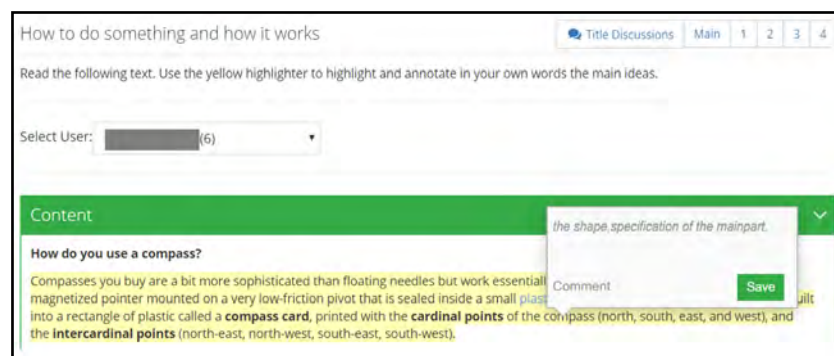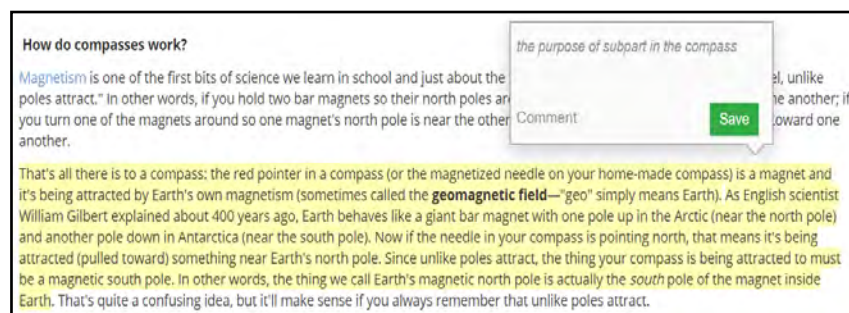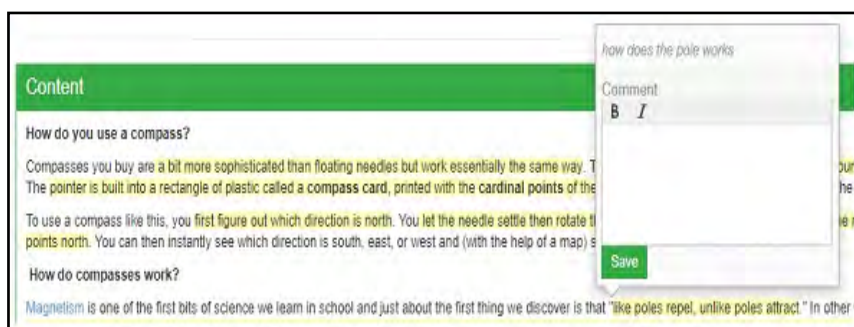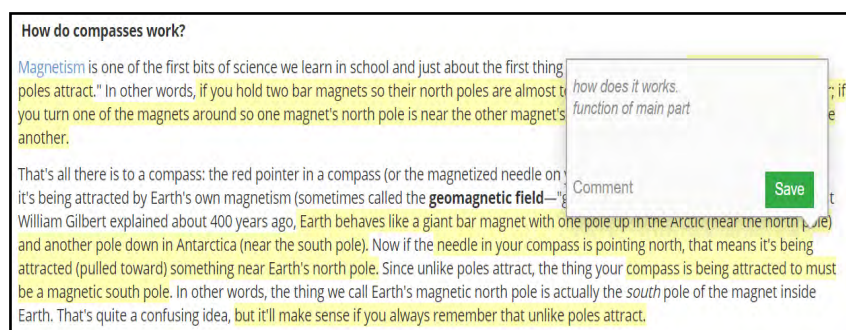

Annotation No. 3:

Figure 3: Screenshot of annotations Nos. 1, 2 and 3 by Student C

Annotations Nos. 2 and 3 were both part of introduction of a technical description that consists of "the shape and location of the object" as well as "the purpose of sub-part" as part of the content element in a technical description. Overall, Student C is consistent in being able to identify paragraph structures as claimed in interview excerpt "…*you want to know **the size, the material, the colour**, so we will focus on that.* The bold words identify the important points stated by students during the interview.

Figure 4 demonstrates two examples in identification of paragraph structure made by Student E.

Annotation No. 1:

Annotation No. 2:

Figure 4: Screenshot of annotation no. 1 and 2 by Student E

Student E was able to annotate "how does a pole work" and "function of main part" as seen in Figure 4. In total, he was able to make 12 annotations (see Table 3), in which 3 did not include any written notes. This indicated that Student E understood parts of an essay on a technical description and was able to identify technical description essay structure.

Improves Understanding
Another major finding was that reading online materials using DAT helps students comprehend the texts better because they are able to paraphrase the text based on their own understanding (as depicted in words and phrases which are in bold). The researcher highlighted the bold words that identify the important points stated by students during the interviews. This theme was derived from interviews about "key stages of making chocolates". The interview excerpts in Table 4 demonstrate this point. The researcher highlighted the bold words that identify the important points stated by students during the interviews.

Table 4: Interview excerpts 2

Student	Interview excerpts
Student K	We **annotate in our way, so we understand better**…**we can just summarize** all the main point then we can know about what the passage say about. It is more clear when reading the text
Student E	For me the annotation tools is quite useful because when the key-point is there and **how they elaborate** is very important and maybe we **can rephrase it** into another words so that we can **easily understand** about that
Student L	I think it [annotation tools] is useful because it is **easier for us to understand what the text is going to talk about.**

Based on Table 4, students K, E and L believe that DAT provide the opportunity to annotate the information read online using their own linguistic knowledge to achieve comprehension. This allows for the opportunity to elaborate the online information to reach comprehension. As a result, learning becomes meaningful when understanding is attained.

According to students, using DAT when reading online materials improves understanding because they were given the opportunity to highlight and then rewrite (through written annotations) the ideas. This was important for students because the online reading materials were complicated because of its S & T entities. This is further elaborated in Table 5. The researcher highlighted the bold words that identify the important points stated by students during the interviews.

Table 5: Interview excerpts 3

Student	Interview excerpt
Student E	I can **read much more better** than before this, because last time some of the words I really can't understand, throughout iREAD and those annotation by phrase and all that, **I can easily understand some of the new word** that never seen before
Student H	While we are writing or going to present something. We have the ideas. The manufacturing of the rice, the process. **Those are all ideas that I now know and understand**
Student C	Erm after we do some activity that we feel that we will **more easy to understand** about what really want to do in the activity related about the activity and what not to do.
Student A	It **makes me more understand** the text and helps me **analyze from sentence to sentence,** assists me to find out main idea and explanations. Gives me an **overall understanding** of the text that I read
Student K	We can, we use the tools so that **we can easily know every details** of the subject about. Yeah, we can also know important, **what the subject is mainly about** the parts or something. So when **I do this it makes reading become easier to understand** because I can organize it this way
Student R	Because previously when I read all these scientific passage, it is all in exam, it is all for exam purpose. So that we just like read the question and find the answer, but through this iREAD, we actually **reading a passage, analyze the passage and then we understand in our own ways**

All six students believe that DAT assisted them in understanding because it provides an outlet to express comprehension of S & T information. As illustrated in Table 5, one possible implication in achieving comprehension of EST online materials is when students were able to summarize the main points. These responses illustrate the students' ability to understand the online materials because they were able to annotate the reading text in a way which is

comprehensible to them. For example, when students were able to paraphrase and elaborate the reading materials that relate to their academic background, they were also able to organize their understanding accordingly. What this means is that topics such as processes that seem to be complicated may be less complicated to understand. This is significantly important because learning S & T in a SL can be rather challenging.

In order to validate the data obtained from the interviews, the study analyzed the annotations made by students. This consists of *Minf* for both highlighted texts and annotation notes made by students. The purpose is to confirm the students' ability to understand the EST online reading materials as claimed in the focus group interviews. Table 6 summarizes the annotations made by students based on the activity in Week 6 (see Table 1).

Table 6: Summary of annotations on Directional Process

No	Student	Highlighted text *(Minf)*	Annotation notes *(Minf)*
1	Student E	26	10
2	Student T	32	4
3	Student L	22	22
4	Student G	9	9
5	Student S	16	6
6	Student K	16	16
7	Student V	0	0
8	Student J	3	2
9	Student C	26	14
10	Student R	29	11
11	Student H	24	17
12	Student A	4	0
	Total	**207**	**111**

Table 6 reveals a total of 207 texts that were highlighted and 111 of which included written notes. This means that 54% were the reproduction of main ideas. This shows that students understand the texts as claimed in the FGIs. They reproduced the main ideas based on their background knowledge and linguistic knowledge. This is complementary to Schema Theory (Carrell, Devine & Eskey, 1988), where background knowledge is matched with textual data. Samples of annotations made by some of the students are shared in Figure 5.

Annotation No. 1:
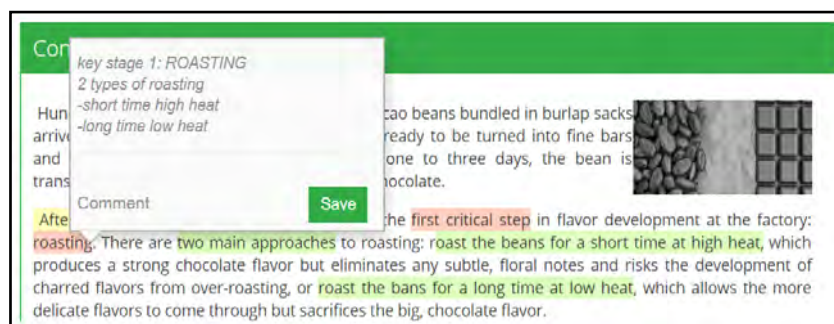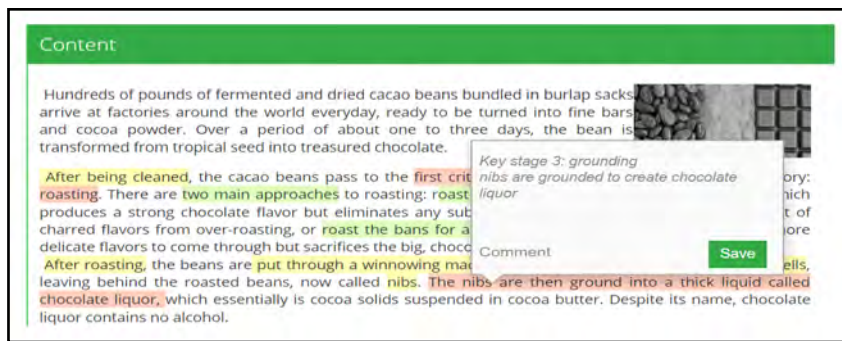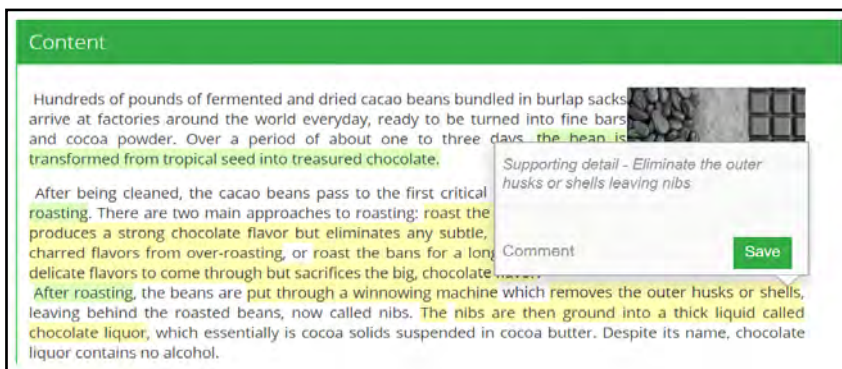
Annotation No. 2:

Figure 5: Screenshot of annotation no. 1 and 2 by Student R

Based on Figure 5, Student R was able to elaborate the first step of making chocolates which is "roasting". Throughout this activity, Student R was also able to identify each key stage systematically. For example, he was able to identify the third stage which is "grounding". As seen in annotation no. 3, he paraphrased the idea through changing the sentence based on his knowledge and interpretation. This is an indication of the use of support reading strategy (Anderson, 2003). As such, Student R was able to use proper reading strategy to facilitate reading of EST online materials.

Annotation No. 1:

Annotation No 2:
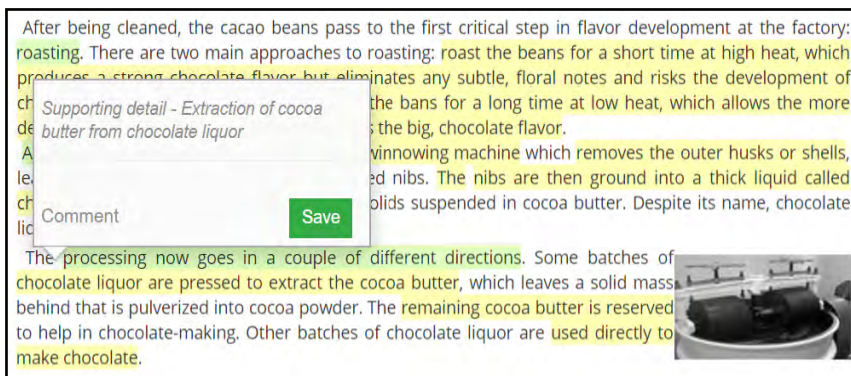
Figure 6: Screenshot of annotation No.1 and 2 by Student L

Figure 6 provides data on annotation notes made by Student L. Student L was able to identify 'supporting details' and elaborate each supporting details. For example, in both annotations, Student L managed to write the supporting details based on his own interpretations. This is consistent with his interview extract "*I think it [annotation tools] is useful because it is **easier for us to understand** what the text is going to talk about*". The bold words identify the important points stated by students during the interviews. Thus, Student L was able to show his understanding of EST online materials through the annotations that were made. Figure 7 are annotations made by Student T.

Annotation No. 1:

Annotation No. 2:

Annotation No. 3:

Figure 7: Screenshot of annotation numbers 1, 2 and 3 by Student T

Figure 7 illustrates three examples of annotation notes made by Student T. For annotation No. 1, Student T rephrased the idea of the first sentence in the paragraph to illustrate understanding of the new information read. In annotations Nos. 2 and 3, Student T was able to rewrite the

sentence into his own understanding by interpreting the text based on his knowledge, thus generating meaning. This was seen throughout the annotation activity that Student T completed. According to Schema Theory, reading is an interactive and constructive process, where reading generates meaning through the process of relating the textual information to existing knowledge (Carrell et al., 1988). Hence, annotations made by Student T illustrate that.

Discussion

The examples shared on written annotations produced by some of the students demonstrates that students were able to identify paragraph structure as admitted by students in the FGIs. The findings are consistent with previous research that concluded identifying paragraph structures as an important entity to assist students in understanding of main ideas, thus develop reading comprehension (Carrell et al., 1988; Meyer, Wijekumar, Middlemiss, Higley, Lei, Meier & Spielvogel et al., 2010). In relation to this, identification of paragraph structure is important for reading comprehension. This is because identifying paragraph structures leads to recognizing and understanding main ideas of the paragraphs (Lo et al., 2013). In addition, utilizing DAT assists students to understand these technical S & T materials, making reading academic texts in English less complicated for ESL learners.

The findings revealed a close relation to Schema Theory where reading is considered a constructive and active process that require readers to understand information based on retrieving and applying previous knowledge. As hypothesized by Li et al (2016), highlighting texts supports reading as it identifies key parts, recall information and act as visual signals. All of these elements are important for ESL learners who are reading ESP texts in their SL. Moreover, highlighting coupled with written annotations is powerful because it contextualizes and synthesizes ideas. These findings play a complementary role in the Interactive Reading Model (Rumelhart, 1977). It is believed that interactive reading provides opportunities to help identify key elements of paragraphs which conforms to some elements of annotations. This allow students to be explicitly ready to deal with syntactic and discourse features that are generally used in the language of EST more easily with the use of DAT. In addition, data obtained with regards to identifying paragraph structure and improved understanding were triangulated with annotation analyses, confirming the validity and importance of DAT.

Finally, a number of important limitations need to be considered. Firstly, there were some technical constraints in using iREAD such as the inability for students to change the highlighted colors twice. Instead, double highlighting was made. Secondly, DAT in iREAD should include social annotation functions to integrate a more holistic approach to teaching and learning. This would encourage collaborative learning among students. This could significantly increase a more interactive teaching and learning approach that is important at tertiary level.

Conclusion

The results reveal that DAT facilitate understanding of EST online materials, since DAT facilitate the process of adding, editing and modifying information in electronic form without making any changes to the resource itself. This was demonstrated in examples discerned from the annotations in which most students were able to identify paragraph structure and improve understanding of the reading materials. The various colors, such as yellow and green, in the highlighting tools assist in reducing the cognitive overload because the highlighting tools appear to provide meaningful cues for students. The highlighting process and written annotations are significant in the process of contextualizing and synthesizing ideas, which

consequently leads to interactive reading. The process of contextualizing and synthesizing ideas will enable students to be prepared and ready in dealing with syntactic and discourse features that are generally used in the language of EST more easily. Furthermore, the highlighting features allow students to focus on the reading task, while being engaged in the annotation process. The annotations can also be seen as an additional layer of information to the existing resources offline, such as discussion in class with the lecturer and other students. To support this, data obtained on how the students identify the paragraph structure as part of the comprehension process in reading the materials were triangulated with annotation analyses. The results confirmed the validity and importance of DAT.

With regards to the Schema Theory, where reading is considered a constructive and active process that requires readers to understand information based on retrieving and applying previous knowledge, highlighting texts significantly supports reading as it identifies key parts, aids recall information, and acts as visual signals. Past studies have proven that learners' comprehension would also be higher when important words, phrases and sentences are highlighted as opposed to when they were not highlighted.

The present study is one of few studies that examined ESL students annotation types in reading EST online materials in Malaysia. There is a need for future research identifying types of annotations based on various ESP subjects such as English for Medical Purposes and English for Legal Purposes. Different subject areas may affect learners use of annotations. Learners may provide different forms of annotations given in different contexts. Different texts and tasks may lead to different approaches in annotating by the learners. This study found a significance in online reading platforms such as iREAD in assisting students in reading EST online materials in their SL. Overall, DAT was able to assist, facilitate and support learning; in a vital area. Reading is an important skill and plays a significant role in successful learning.

Acknowledgement

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