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EXPLORATION OF ONLINE DISCUSSION FORUM ON READING EST TEXTS FOR ESL LEARNERS

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ABSTRACT

Purpose: This study explored ESL learners' utilization of Online Discussion Forums (ODFs) in Interactive Reading for Academic Disciplines (iREAD) to assist reading of online scientific texts within an English for Specific Purposes course at a public university.

Method: This qualitative research employed two data collection methods during lessons of a 14-week semester. The first was analysis of ODF threads in iREAD from 30 ESL learners of various engineering programs at a public university in the East coast of Malaysia. Twelve from 30 ESL students were purposively selected to participate in focus group interviews. Interactive Analysis Model was used to analyse the

threads, whilst the interviews transcripts were analysed thematically. NVivo Pro 12 software was used to manage the data and the generated themes were later analysed using inter-rater reliability analysis. The Kappa values of the themes indicated near perfect scores, to verify the reliability of the identified themes.

Findings: The findings revealed the positive capability of ODF as a tool in facilitating learners' reading comprehension of English for Science and Technical (EST) online materials. Analysis of the data on ODF threads confirm that students have the capabilities to engage in higher level of discussions and debate to aid their understanding. The themes that emerged from the interviews reflect positive impacts to facilitate reading of EST online materials, where learners were able to work collaboratively and increase knowledge and understand better. In addition, significance of EST materials was important in providing exposure to students' background knowledge of their content courses. The notion of social constructivism and connectivism were reflected as learners constructed knowledge, negotiated, and synthesized ideas using the language across networked learning communities.

Significance: An implication from this study suggests that exposure to EST online materials through communication and collaboration via ODF has strengthened students' knowledge of the subject content. Additionally, learners' comprehension of reading online EST materials has been enhanced through ODF because of the tool's interactive heuristic approach to learning. This becomes significant for program developers and lecturers to combine both elements of ODF and material selection in lessons considering its positive impacts toward learning.

Keywords: Online discussion forum, Online reading, English for Science & Technology, Learning Management System.

INTRODUCTION

The national policy on Science, Technology, and Innovation in Malaysia urges society to bring about beneficial scientific and technological contributions for future advancements that are forward-looking and innovative to cope with the scientific and progressive demands of the world (Ministry of Science, Technology, and Innovation, 2016). This

means the ability to cope with social and environmental issues require an increasing degree of scientific and technological literacy for society to understand, and for the later decision to be made to trigger the right actions. Science literacy, since then, has become an overarching goal for the country to become a developed nation. Science literacy involves the skill to read and examine data presented in diagrams on websites (Ho et al., 2014) as well as scientific information. For science education in particular, students are required to interact with online scientific information resources by reading scientific-related topics on the internet and reading scientific data. In other words, it is crucial for students, especially at the tertiary level, to have English language reading ability in reading science-based materials that would allow them to scrutinize and evaluate texts.

In Malaysia, English is considered as a second language. It is widely used in tertiary education such as in the field of English for Science and Technology (EST) (Abdul Hamid, 2010; Kalpana, 2017). Without a doubt, reading scientific texts with its unique features (Abdul Hamid, 2012), pose a barrier for ESL readers because English for Science and Technology (EST) reading materials generally contain complex technical content. For instance, due to its perplexing structure, reading EST texts can be a barrier to ESL learners who are trying to understand abstract concepts at a more advanced level. Kalpana (2017) asserts that these learners face two plausible challenges, the language, and the content. Simply to say that these ESL tertiary level learners in public universities in Malaysia are reading to learn, but their learning of scientific knowledge is impeded when they are unable to comprehend the text.

This has led Malaysian English language instructors to resort to numerous pedagogical approaches to enable Malaysian ESL learners to comprehend EST texts and, the use of technology has become the most viable tools to serve this purpose. Technological tools are proven to be effective in assisting and facilitating ESL learners reading of EST online materials in various ways (Ruhil Amal et al., 2020) as well in accommodating the prevalent importance of online learning particularly during this pandemic era, where most instructors have increased their efforts in selecting digital educational spaces such as Learning Management Systems (LMS), blogs, web-based gamification and ODF that cater to Malaysian ESL learners' needs.

These digital spaces are commonly employed to assist learners in various ways. The use of ODF, encourages learners to engage in discussions that can lead to higher knowledge co-construction through critical and reflective thinking (Goh, 2019; Hew & Cheung, 2010; Jamali & Krish, 2021). In fact, Zhao et al. (2019) identifies online discussion forum as an indispensable tool of the online learning environment to promote learners' deep learning. The collaboration improves learners' use of technologies in which it allows them to socialize via various collaborative methods with the inclusion of social media (Zarzour & Sellami, 2017). Nobody is excluded from interacting because in most ODFs, discussion threads are presented in a chronological order in which the most recent reply will automatically go to the top of the forum (Sun & Gao, 2017). This marks the importance of seamless technological tools utilization for learners to achieve their expected learning outcomes.

However, much of the current research is concentrated on the effectiveness of ODF for pedagogical purposes (Adams et al., 2020; Afify, 2019; Hew & Cheung, 2010; Romero et al., 2013). In contrast to reading general English materials, scarce attention has been specifically emphasised on the use of ODF in facilitating reading of EST online materials at the tertiary level (Kalpana, 2017; Mahapatra, 2020; Malmor & Bagheri 2019; Yong, 2019). In terms of technology integration for ESP related courses, most studies resonate with the importance of context dependence. Mahapatra (2020) underscores the appropriateness of technological tools for ESP courses based on learners and instructors' volition in using the tools, infrastructural facilities, and the extent of its integration in ESP syllabus. To add, the strengths of the tools and its limitations must be made known in determining the types of technological tools that work best for learners (Yong, 2019). Overall, the selection of technological tools for EST is related to curricular decisions, which requires learners as well as instructors' active participation. Therefore, using Interactive Reading for Academic Disciplines (iREAD) as a pedagogical platform to address the gap, this study intends to answer the followings questions:

1. In what ways do Online Discussion Forum assist ESL learners in achieving phases of knowledge construction in reading EST academic materials online?
2. To what extent does ODF aid ESL learners in reading EST academic materials online?

LITERATURE REVIEW

Theoretical Foundations

This study is mainly guided by Interactive Analysis Model (IAM), Connectivism theory and Social Constructivism. IAM is a model that identifies knowledge constructions through collaborative learning (Hew & Cheng 2010). IAM, created by Gunawardena et al. (1997), which was later improvised by Li (2004), identifies five phases of knowledge construction based on a constructivist learning environment. These processes include sharing opinions, agreeing, identifying areas of disagreement, negotiating concepts or terms, and testing or applying ideas. In addition, Social Constructivism identifies collaborative learning as an approach for learners and teachers to increase cognitive development by constructing knowledge with each other (Vygotsky, 1978). In relating these two theories to this study, ODF is associated with cognitive and social learning processes because students were interacting in an online platform within a collaborative learning environment.

Connectivism theory is also applied to emphasize on learning that takes place across network learning communities and technologies. It is dubbed as "the learning theory for the digital age" by Siemens (2004, p. 4) because learners use multiple technologies and resources to connect to ideas located among their personal learning networks (Dunaway, 2011; Kropf, 2013; Utecht & Keller, 2019). The learning process acknowledges the importance of networked information technology that is also used in many recent technologies such as MOOC, YouTube, Diigo and Facebook (Goldie, 2016).

Online Discussion Forums as a Technological Tool for Pedagogical Activities

Online discussion environments such as asynchronous ODF used in institutes of higher learning, are usually used to support learning because they encourage discussions, without the limitations imposed by time and space. For ESL students who need to practice their English language communication and literacy skills, these students can reflect, interact, ask questions, and work collaboratively in ODFs. These discussion forums are used extensively because they promote networking and opportunities to interact beyond the normal classroom setting. At the same time ODF generates a feeling of confidence

with no restrictions in conveying personal opinions and thoughts as it encourages introverts to also be more open to sharing their views (Jamali & Krish, 2021; Nor Fariza et al., 2012).

Research found that asynchronous online discussion forums are better to synchronous face-to-face discussions as they encourage critical thinking and knowledge co-construction because of the ability to reflect (Afify, 2019; Beckmann & Weber, 2016; Klisc, 2015). For example, Goh (2019) analysed knowledge building in online discussion threads among 18 students and a facilitator for three weeks. Using Atlas.ti, a qualitative software for data organization, more than 200 discussion threads were analysed and concluded that ODF encouraged reflection in problem-solving situations within a collaborative environment. She found that learners were able to connect to real life problems and create questions that were related to real life situations when they used ODF in their learning (Goh, 2019).

Asynchronous discussions have also proven to be essential for online courses as they are versatile and adaptable techniques in providing learners with opportunities to communicate and discuss issues with each other. Jamali and Krish (2021) conducted a study among 26 undergraduate students in a public university in Malaysia concluded the need to incorporate digital technologies such as ODF to promote learning and develop digital skills, which is an important criterion to stay relevant in the current educational environment. The findings were gathered from semi-structured interviews, reflective journals, and online discussion threads. From the study, they identified ODF abilities in improving 21st Century Skills such as critical thinking, discipline, leadership, time management and computer skills.

These studies have highlighted the advantages of ODF in educational settings both in Malaysian and foreign contexts. The findings show that ODF allows a safe space for students of different characteristics to intellectually discuss without facing forms of prejudice, and they are allowed to mull on the ideas discussed, do readings, and research before answering the questions points to its practical affordance in building efficacies in students on their education process.

English for Science and Technology (EST) and Technology Integration

English for Science and Technology (EST) has distinct features because the emphasis is on specific discourse, vocabulary, and register

(Basturkmen, 2012; Yong, 2019) for English language learning and its usage in technical fields of study (Malmir & Bagheri, 2019). In the past four decades, EST has expanded alongside the heightened need of science and technology and its publications in English medium journals (Kim, 2013). EST courses not only focus on the teaching and learning of scientific vocabularies and linguistic features related to science and technology, but it also accentuates on the authenticity of the course content (Mansouri, 2010). In such EST courses, learners gain the language abilities that are relevant in their future area of specialization such as through English of Biology, the English of Medicine, and the English of Engineering. It is used in explanations or descriptions of scientific citations, works, reports, theses, and research papers. Above all, EST deals with English varieties that are related to the applications and theories of science, technical or technological subject matter.

Apparently, the domain of EST has broadened in various academic majors. Particularly in engineering academic programmes, EST emphasis on specific literacies acquired in the context of the discipline is generally acknowledged due to the ever-increasing areas of the field (Malmir & Bagheri, 2019). In other words, the teaching of EST materials should enable ESL engineering learners to relate with their background knowledge, encourage critical thinking and make comparisons (Ruhil Amal et al., 2020). Due to EST distinctive syntactic and discourse features for science and technical fields, Abdul Hamid (2012) asserts that scientific texts require its readers to be linguistically competent in the language and be informed and knowledgeable about certain scientific concepts reiterated in the text. Therefore, the use of EST materials, apart from to cater to learners' needs (Kim, 2013), should be notably aided with the use of technological tools for the learners to better comprehend engineering related texts. Most importantly, learners need to be engaged in a more constructive environment when they are introduced to materials relevant to their academic fields. Hence, the researchers have adopted ODF in iREAD as the technological tool in assisting learners to read and comprehend EST online materials. The interactive and collaborative nature of ODF, which is supported by the theories, is expected to promote authentic and meaningful discussions of EST materials through learners' active construction of knowledge via a network of learning communities and technologies.

METHODOLOGY

This is a qualitative study that focuses on ESL learners' utilization of ODF in Interactive Reading for Academic Disciplines (iREAD) to assist online reading of EST materials within an English for Specific Purposes course at a public university in Malaysia. iREAD is an online reading system developed by UKM experts that integrates the use of various reading tools such as annotations, ODF, video and audio features (Nor Fariza et al., 2014).

Since this study aims to understand ESL learners' concepts, opinions, or experiences reading EST materials via ODF in iREAD, the first data set was from ODF threads of postings made by students, while the second data set was gathered from focus group interviews. Since the aim was to gather in-depth insights on the use of ODF within iREAD in assisting a group of ESL engineering and technical learners reading EST online materials, a descriptive approach was chosen to explore how the students perceive and make sense of their experiences. This forms a method triangulation of this qualitative research strategy in which the validity is tested through the convergence of data (Carter et al., 2014) from ODF threads and interviews. Triangulation refers to the use of multiple methods or data sources in qualitative research to develop a comprehensive understanding of the phenomena (Patton, 1999). At the same time, to support one of the themes found in FGI, analysis on phases of knowledge construction based on IAM will be discussed, which also forms the basis of triangulating the data. The study was conducted in an English for Technical Communication (ETC) course that largely consists of reading EST materials and related activities where iREAD was susceptible in promoting ODF.

Participants

This study adopted purposive sampling to collect data from 30 ESL learners enrolled in ETC from various engineering and technical courses in a public university in Malaysia. According to Creswell (2014) purposeful sampling refers to intentionally selecting a sample that explores the main concept being studied. Hence, a sampling of *n=30* was selected from 614 students because they were enrolled in ETC at the university in Semester 1, 2016/17. These 30 students took part in using iREAD as part of teaching and learning that semester,

particularly with the use of ODF. Hence, the data set from online discussion threads were taken from this sample *(n=30)*. Out of these students, homogenous sampling of 12 students was used as a sampling strategy for qualitative data collection. This group of people is purposely selected because they are a part of a group that has similar and significant characteristics; they all previously took the same course (English level 1 – English for Academic Communication), were currently enrolled in the same course (English level 2 – ETC) and achieved band 3 in Malaysian University English Test (MUET). For the FGI, the students were selected based on their participation in iREAD. They were either categorized as active *(n=4)*, moderate *(n=4)* or non-active *(n=4)* users of iREAD. Only four students were selected from each category as the researchers believed it would provide sufficient data for this qualitative study. The students were between 21 and 23 years old and were from the same course. They have consented to participate in the study hence, to attend twice a week for a two-hour tutorial and a two-hour lab class respectively. They were also given the permission to withdraw from the study in case they were no longer interested to participate in the study. This was to ensure voluntary participation and that no repercussions would be involved if they did not want to participate in the study.

Research Instruments

Online Reading System: iREAD

Online discussion thread data were collected using the Interactive Reading for Academic Disciplines (iREAD) platform. While the system contains a variety of online tools, the current study focuses only on the ODF as the main feature. Through ODF, students' online posts were collected in the fifth week where students responded to two videos that they watched on the topic of Process Explanation. After viewing the two videos, students were required to provide their opinions on the differences between the two videos in the Discussion Page provided. They were encouraged to provide feedback or comments on their friend's opinions as well. Each online discussion thread made by students were treated as a unit of analysis, where an online knowledge construction framework (see Table 1) was used to interpret each analysis based on the phases of knowledge construction. This provides an overview on the levels of knowledge constructions that took place among students in an online environment.

Focus Group Interview Protocols and Questions

Focus Group Interview (FGI) encourages the expression of opinions when individuals are put in a group because it inspires group members to be more reflective regarding the topics discussed. It creates patterns of shared meanings across the group and carries weight on analytic generalizations (Hatch, 2002). The FGI protocol was designed by the researchers to ensure smooth flow of the sessions as naturally as possible on covered topics, follow-up, and probed questions. There were two homogenous groups of six students which were led by a moderator or facilitator to create a motivating atmosphere for the discussion to develop. The session was conducted after class hour in the respective labs, where each session took about an hour each. The students were prompted on questions related to the use of ODF in reading to understand online EST materials. Prior to this field work, the questions were sent for expert review and revised accordingly. Generally, the protocol established the conducted FGI verifiable procedures, systematic analysis of the collected data and appropriate reporting that followed.

Data Collection

The data was collected twice (week five and seven) during a 14-week semester. In the fifth week, the students (*n=30*) were involved in an ODF on Process Explanations and FGI. For this activity, the students were required to view two videos on "how to make a red velvet cake" and "how does rice grow". They were then required to discuss in iREAD the similarities and differences that were observed in the two videos. The students' online postings data were collected to provide an overview on the levels of knowledge constructions and were then validated by two appointed inter-raters. To validate the themes, Cohen Kappa inter-rater reliability was used to formulate the probability of similarity between the raters. The average kappa value yielded an almost perfect score (.81) for the discussion page which indicated high reliability of the data.

In the seventh week, another round of data was collected through FGIs among 12 students. The FGI sessions were conducted during the students convenient time which was at the beginning of the semester break (end of week 7). The objective of the interview was to allow

students to reflect on the significance of using ODF in reading EST materials in iREAD. Cohen Kappa inter-rater reliability score yielded (.77) which indicated a substantial agreement on the coding scheme created by the researchers.

Data Analysis

Both online discussion threads and FGI data were analysed thematically. For the ODF data, a five-phase Interactive Analysis Model (IAM) by Gunawardena et al. (1997) were used to analyse knowledge construction between students based on the transcripts of the online discussion threads. IAM was developed based on online interactions for an online debate about distance education "to determine whether knowledge was constructed within the group through talk and dialogue, and whether participants changed their understanding or developed new knowledge as a result of group interaction" (Gunawardena et al., 2016, p. 38). The model consists of five phases of knowledge construction which is grounded in the social constructivist theory (Vygotsky, 1978). In this study, the five-phases of IAM were used to understand the knowledge construction between the students in ODF. Table 1 illustrates the descriptions for each phase of IAM.

Table 1

Interactive Analysis Model (Gunawardena et al., 1997)

Phases	Description
Phase I	Sharing/ comparing information
	A statement of observation or opinion
	A statement of agreement from one or more participants
	Corroborating examples provided by one or more participants
	Asking and answering questions to clarify details of statements
	Definition, description, or identification of a problem
Phase II	The discovery and exploration of dissonance or inconsistency among ideas, concepts or statements

(continued)

Phases	Description
	Identifying and stating areas of disagreement
	Asking and answering questions to clarify the source and extent of disagreement
	Restating the participants position, and possibly advancing arguments or considerations in its support by references to the participants experience, literature, formal data collected, or proposal of relevant metaphor or analogy to illustrate point of view
Phase III	Negotiation of meaning/ co-construction of knowledge
	Negotiation or clarification of the meaning of terms
	Negotiation of the relative weight to be assigned to types of arguments
	Identification of areas of agreement or overlap among conflicting concepts
	Proposal and negotiation of new statements embodying compromise, co-construction
	Proposal of integrating or accommodating metaphors or analogies
Phase IV	Testing and modification of proposed synthesis or co-construction
	Testing the proposed synthesis against "received fact" as shared by the participants and/ or their culture
	Testing against existing cognitive schema
	Testing against personal experience
	Testing against formal data collected
	Testing against contradictory testimony in the literature
Phase V	Agreement statement (s)/ Applications of newly constructed meaning
	Summarization of agreement (s)
	Applications of new knowledge (s)
	Metacognitive statements by the participants illustrated their understanding that their knowledge or ways of thinking (cognitive schema) have changed because of the conference interaction

Subsequently, the data analysis process for FGI employed thematic analysis using the six steps discussed by Creswell (2014). The analysis

process was made easier with the use of NVivo Pro 12 software to manage the data. The qualitative data analysis of FGI summarizes the process involved in data analysis from raw data to being themed and lastly, interpreted and validated to answer the two questions of the study.

FINDINGS AND DISCUSSION

The findings and discussion are presented in accordance with the two research questions of the study. The first was to explore ways in which ODF assists university ESL learners in achieving phases of knowledge construction in reading EST academic materials online. Secondly, the findings explored the extent to which ODF aid reading of EST online academic materials. The discussion on findings is presented according to the research questions formulated. The extent to which ODF aid reading of EST online academic materials.

RQ 1: In what ways do Online Discussion Forum assist ESL learners in achieving phases of knowledge construction in reading online EST academic materials?

Phases of Knowledge Construction

The first research question was to examine phases of knowledge construction in ODF among ESL learners. Based on each posting, data was thematically analysed using the five-phases IAM by Gunawardena et al. (1997). This model illustrates phases of knowledge construction and negotiation of meaning within an online discussion environment. Each posting in ODF made by a student is considered as a unit of analysis. For the purpose of this study, one discussion thread was selected to identify knowledge construction among the students. The analysis on the levels of knowledge construction within the thread was based on 26 ODF postings collected from iREAD on the topic of Process Explanations. Table 2 presents the number and percentage of postings made by the students according to IAM phases.

Table 2

Analysis of Phases of Knowledge Construction in ODF during the Fifth Week Discussion

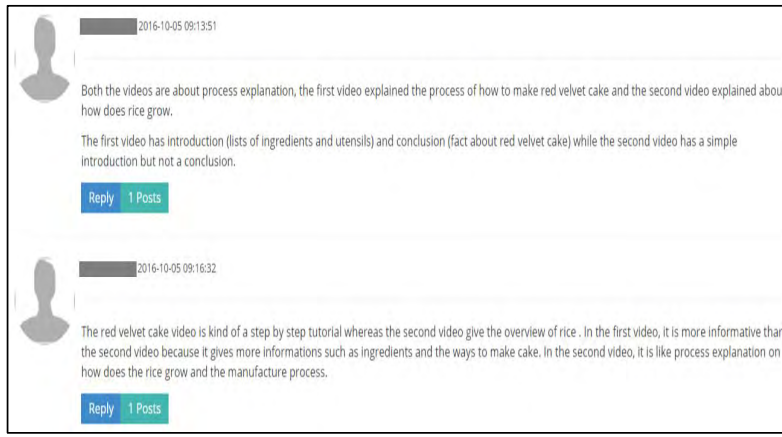
Phase	Description	No of Posts	%
I	Sharing/ Comparing of information	10	40
II	Discovery and exploration of dissonance or inconsistency among participants	2	8
III	Negotiation of meaning/ co-construction of knowledge	7	28
IV	Testing and modification of proposed synthesis or co-construction	5	20
V	Agreement statement (s)/ application of newly constructed meaning	1	4
	TOTAL	26	100

As depicted in Table 2, the analysis on phases of knowledge construction among the students in Week 5 shows that almost half of the postings made by students occurred in Phase I (40%) and Phase II (8%) put together, which is on sharing/comparing and discovery of information. However, Phase III (28%), Phase IV (20%) and Phase V (4%) outnumbered Phases I and II combined in phases of knowledge construction. This indicates that students were able to move beyond merely exchanging information; in fact, the students were able to negotiate and synthesize ideas. This suggests that students were able to form connections with people, ideas, and opinions in a learning network (Siemens, 2004).

It is interesting to note that there was still quite a high number of postings that was found in Phase III (28%) in IAM. Phase III in IAM consists of negotiation or co-construction of knowledge. This means that students moved beyond sharing information or questioning and were able to negotiate or clarify the meaning of terms. In this example, the meaning and terms of informative and directional processes that are identifiable in the two videos posted. This corroborates the notion that asynchronous online discussions encourage knowledge co-construction as students are more critical and constructive in learning (Beckmann & Weber, 2016) and that visual scaffolds in knowledge acquisition are effective (Chou & Hsiao, 2010; Roohani et al., 2013). Figure 1 is an example of ODF posting for Phase III.

Figure 1

Example 1 of ODF posting for Phase III



In Figure 1, the student was able to describe the differences between these two types of process explanations by providing justifications why one video is considered informative as "*it gives more information such as ingredients and the ways to make cake*". Another example showed that a student was also able to analyze, interpret and reorganize ideas. This also denotes Phase III in IAM. Another example of a student's posting in Phase III is illustrated in Figure 2.

Figure 2

Example 2 of ODF posting for Phase III

Based on Figure 2, the student was using Phase III in IAM. As seen, this student was able to identify areas of agreements or disagreements and provide justifications when the student responded, "*the information*

is delivered in a clear way together with the…However, the second video showed less words". This denotes that the student was able to make the comparison and justified it by presenting his arguments. Another example of Phase III is shared in Figure 3.

Figure 3

Example 3 of ODF posting for Phase III

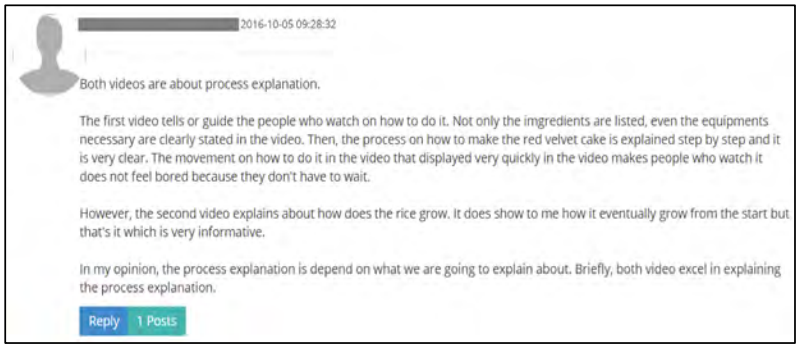


Figure 3 is a valid interpretation of Phase III in IAM, where the student was able to clarify the meaning of the two types of processes. For example, the posting started off with an explanation about the first video that *"tells or guides…how to do it"*. This signifies that the student could differentiate between the two videos: one being directional and the other informational. The posting also included a closing that reflected the student's opinion about process explanations in general.

The analyses of this fifth week indicated that the students were able to move beyond Phase II of knowledge construction because more than half (52%) of the 26 ODF postings were considered as Phases III, IV and V. The ODF postings have proven that the students have achieved higher levels of knowledge construction in a reading activity. This reveals the students' abilities to co-construct meaning from reading the EST materials, justify ideas and construct new ideas.

RQ2: To what extent does Online Discussion Forum assist ESL learners reading of online EST academic materials?

In the second part of this study, the data were gathered from FGI sessions among 12 students in the seventh week of the study. Based

on FGI data were thematically analysed and presented. Three themes emerged, namely: 1) work collaboratively, 2) increase knowledge and 3) understand better.

Work Collaboratively

Several salient categories under the theme 'work collaboratively' were identified namely, interacting with one another, stimulating, or exchanging ideas and view different opinions. This was also extended to instructors who joined in the discussion. The themes are illustrated in Table 3.

Table 3

Work Collaboratively Theme

STUDENT	INTERVIEW TRANSCRIPTS
C	So we will more improve our skill la. Yeah become more focus. **We get to learn together too**. **Interact, communicate with each other**.
E	So it kinds of open new perspectives towards learning. It **helps me to collaborate in groups**
I	We can **see others views** for that particular task. We can **exchange our ideas** to know what they are thinking about. When presentation, we need to **think some special idea to attract attention** from your audience. It helps instead of we just sit around table and discuss
G	During a discussion forum, **everyone can post about their ideas** as everyone has different ways of thinking different ideas so during discussion forum we can actually **stimulate the ideas and learn from the others**. Learning becomes more meaningful and builds towards increasing our knowledge.
H	Very useful it is a big step ahead, if we look back to traditional teaching method the interaction between the lecturer and student are restricted in the classroom so by using discussion forum, student can **discuss and the lecturer can interact with the students**.
V	**Everyone will have different thinking** on the same video and they write it up and I also write it up. Then they say they video is this way, you can understand in this way. Oh she understand like that way. So **we can see different opinions** there
J	We can **see the other people's opinions** also, so by online discussions, we cannot just learn by ourselves but **we can learn by a team**

The interview transcripts demonstrated the opportunity to interact with each other and collaborate in groups. According to Vygotsky (1978), when learners share experiences with others, they learn more because others have different skills and backgrounds that allow them to influence one another as they learn together. Collaborating also allows students to stimulate or exchange ideas. When students are given the opportunity to collaborate within ODF, they are also able to stimulate or exchange ideas.

For example, Student G believes that ODF is a medium for students to post their ideas and comments. These ideas and comments may be different, allowing them to stimulate ideas and exchange opinions. Similarly, Student H believes that with ODF, students can create new ideas through exchanging information among each other. As such, creating learners who are actively involved in learning when they can construct new ideas as they play a big role in the discussion (Jamali & Krish, 2021). In another example, Student V believes that everyone thinks differently. In such a way, ODF provides the student the opportunity to view others' opinions. Moreover, Student J believes that it is important to look at other people's opinions because it is not possible to learn alone. In fact, studies on participation in ODF have recorded improvements in academic performance among the students (Hwang & Arbaught, 2009; Romero et al., 2013). This form of knowledge sharing encourages learning in a more interactive way. The embodiment of online collaborative learning is evident when the students engage in the discussion through their posting in trying to comprehend the EST materials.

Increase Knowledge

According to the students, as their English proficiency develops so do their knowledge of EST. This is because the activities in iREAD expose students to EST materials that contain new information or knowledge in English. This new knowledge is also significant in their academic fields of study. During the FGI, the students described ways in which ODF increased their knowledge, while the online discussed threads on phases of knowledge construction will support this theme, as illustrated in Table 4.

Table 4

Increase Knowledge

STUDENT	INTERVIEW EXCERPT
C	For the activity we do in the iREAD, we can, for example **we learn about the process explanations**, firstly when I am reading I am reading the slide in the class, I am not so understand about the slide what are talking about the process explanation. After I do the activity like see the video and **summarize the main idea in the video and then discuss about it, then I know that this process explanation is about what.**
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 one (discussion forums), we actually **reading a passage, analyse the passage and then we understand in our own ways** and we just discuss in the forum
G	We can **share our knowledge** to others about based on what we know or what we learn in current life. At the same time we **get knowledge** when we see the comments others make in discussion forums.
K	For me, there got some video that we never look before. So we can go to discussion forum then watch the video then **we will know about what the things about** and will know them well
H	We can **get extra knowledge about science and technology** that is happening nowadays help us in writing too, strengthen out brainstorming skill.

As seen in Table 4, the evidence suggests that knowledge in EST is attained through the exposure of materials in students' second language (SL). For instance, students become aware of terminologies, steps, and processes through the ODF activities. According to Social Constructivism, collaborative learning is a powerful approach to actively construct knowledge for teachers and learners and to increase intellectual development (Vygotsky, 1978). Analysis on phases of knowledge construction based on IAM validated this theme.

Understand Better

ESP can be very difficult to understand especially when students must deal with EST topics in their SL. This is because the terminologies

used are technical and can be rather challenging especially if English is not the first language (Ho et al., 2014; Langan, 2010). That was why one of the important criteria in text selection for iREAD had to relate to S & T students for students to be exposed to various EST online materials. Exposure to EST materials is important to strengthen students' background knowledge, which becomes extremely relevant to their field of studies. Table 5 illustrates students' ability to identify and understand processes.

Table 5

Understand Better

STUDENT	INTERVIEW EXCERPTS
H	**I get to know the process** for example the **rice making process**. I get to know every single step
S	I can **know the process** of the chocolate and then I can apply the strategy of reading skills on the passage. Read through the passage first, know the main points, title of the passage, we can **know the process** of how the chocolate undergoes
E	For the 1st video, **I learn how to** make a cake. While for the 2nd video, **I am able to know how** rice grow. For the compass text, can know how to use and how the compass work
K	I also **learn how to** make the cake. We able to **know how to use** the compass because sometimes the compass is needed in our life.
H	In my opinion, those activities actually **help students in term of process, steps or procedure**. By watching the washing machine video, students get to know how washing machine works. Same goes to the reading comprehension Tsunami, students can understand the process of Tsunami. **Students from science and technology background can be strengthened in term of process and steps**. Throughout those activities, students get to know which steps come first.

Table 5 illustrates students' ability to identify and understand processes. For example, rice making process, how chocolates are made, how to make a cake and how to use a compass. The significance of introducing these processes allowed students to identify types of processes, the processes involved, and terminologies related. As Kim (2013) suggests, it is important to select ESP materials based on S &

T references to fulfil the academic needs of students. Hence, the data sets from FGI supports the data obtained from the data set on phases of knowledge construction, where ODF was able assist reading of EST academic materials through working collaboratively and increasing knowledge of course content.

In addition, the interview transcripts illustrate that exposure to EST materials would strengthen students' background knowledge in terms of description of processes. Thus, the ability to identify and understand the processes involved played a big role for students to obtain English language reading ability in reading science-based materials and at the same time understand complicated EST online materials they were dealing with. As hypothesized by Dudley-Evans and St John (1998), ESP have absolute and variable characteristics such as meeting the specific needs of learners.

CONCLUSION

As ODF facilitated the reading of EST online materials, the ODF presented in this study proved to be beneficial for interactive learning and student knowledge development, as well as for student collaboration. Students improved their reading comprehension because of their collaborative abilities. This demonstrates that ODF was beneficial at assisting language learners, particularly in reading EST online materials, and that learners readily embraced and utilised it. Moreover, the findings also indicate that social constructivism is associated with communication and collaboration. It encourages the development of individualized internalized principles that go beyond the simple collection and memorization of information because students were also able to provide examples and discuss ideas. This form of knowledge construction embodies collaborative learning.

In addition, students were able to increase their knowledge because they were able to move beyond sharing or exchanging ideas. They were able to negotiate and synthesize ideas, analyse, interpret, and reorganize their ideas as well. Connectivism was reflected because students were able to construct knowledge across learning communities and technologies (Siemens, 2004). This is because students were able to make connections between ideas, concepts and knowledge when navigating within iREAD. However, to ensure students' success in

asynchronous discussion forums, educators should consider key components and constraints of ODFs.

This study also demonstrated that the discussion forums used as data for this study contain evidence of the various stages of information sharing, demonstrating that information is truly constructed and exchanged in the ODF. The practical application of ODF in the study showed that digital space is also effective in the development of knowledge of students. The fact that the students are more engaged in level III and beyond level of discussions indicates that ODF has the capabilities to nurture a space for students to engage in higher level of discussions and debate to aid their understanding and knowledge development. The fact that communication is allowed to be asynchronous, plays an important role in having the discussions to a higher level, as students are afforded time to reflect and mull on their opinions and the opinions of others in the learning process.

Selection of EST online materials was an important component in ODF. The findings revealed that the activities selected were important and significant because students were able to sustain the information. For example, viewing complicated concepts using videos. As stated by Ruhil Amal et al. (2020), it is more efficient to teach concepts with the use of visual scaffolds. This enhances understanding and increases cognitive thinking. Thus, exposure to EST materials provided students with the background knowledge that in turn will fulfil the academic needs of students.

Given the findings of this study, more research should be conducted to determine the implications for best practices and caution when utilising ODF to support reading comprehension and knowledge construction, including a comparison of a variety of current and potential ODF technologies in the reading domain, as well as the extent to which collaborative-learning processes vary according to the type of collaborative-learning process. Additionally, future research should focus on approaches to elevate collaborative-learning dialogues to a deeper level within EST classrooms.

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