Article

Impact of E-Learning Activities on English as a Second Language Proficiency among Engineering Cohorts of Malaysian Higher Education: A 7-Month Longitudinal Study

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Abstract: Recent technology implementation in learning has inspired language educators to employ various e-learning techniques, strategies, and applications in their pedagogical practices while aiming at improving specific learning efficiencies of students. The current study attempts to blend e-learning activities, including blogging, video making, online exercises, and digital storyboarding, with English language teaching and explores its impact on engineering cohorts at a public university in Malaysia. The longitudinal research study used three digital applications—Voyant Tools, Lumos Text Complexity Analyzer, and Advanced Text Analyzer—to analyze the data collected through a variety of digital assignments and activities from two English language courses during the researched academic semesters. Contributing to the available literature on the significance of integrating technology innovation with language learning, the study found that implementing e-learning activities can provide substantial insights into improving the learners' different linguistic competencies, including writing competency, reading comprehension, and vocabulary enhancement. Moreover, the implementation of such innovative technology can motivate students to engage in more peer interactivity, learning engagement, and self-directed learning.

Keywords: e-learning; english language teaching and learning; writing competencies; reading comprehension; vocabulary enhancement

1. Introduction

The current age of technology has opened a whole new world of digital applications across all domains of human life. Recent advancement in information technology not only direct educationists to explore new purviews of learning but also motivates education practitioners to implement new technologies in their pedagogical strategies. The practice of e-learning in the field of education, both in schools and higher educational institutions, is an old yet considerably vigorous development of technology that keeps creating new dynamics in learning. Further, the development of e-learning has resulted in blending technology with pedagogical methodologies, which certainly benefits teachers and learners alike in improving their teaching and learning proficiencies. Particularly, the blend of technology and learning is highly advantageous for teaching and learning English as a second language (ESL). Language and technology, as two rapidly evolving areas, are constantly shaping and influencing each other. The dynamic nature of language and technology can be seen in the way that new words and phrases are constantly being created to reflect changes in technology and how technology is being developed to facilitate new forms of communication. As technology continues to advance, language is likely to continue adapting and evolving in response. Therefore, their blend is a significant reference point in the systematic inquiries of technology innovations and language learning strategies [1,2]. It further aligns with the

current study that explores and analyzes innovations and best practices across technology-integrated educational mechanisms, particularly ESL classrooms. The global perspectives of the English language have opened new possibilities for employing various e-learning methods and applications in teaching and learning English courses, resulting in greater benefits. While addressing the applications and relevance of online learning, certain terms and practices are widely implemented across education systems, including e-learning, blended learning, and virtual classrooms [3,4].

1.1. Terms and Concepts

The concept of e-learning is generally described as instruction-based learning that is delivered using various electronic technologies [5]. E-learning encompasses a wide range of applications and processes, including web-based and computer-based learning, virtual classrooms, webinars, and so on, delivered over the Internet [6]. The concept of blended learning is defined as the use of online learning along with traditional face-to-face instruction in different learning environments to support teaching and learning [2]. In a blended learning environment, students interact with their teacher, course materials, and peers through a learning management system (LMS) that manages all the teaching and learning activities. Blended learning combines traditional classroom and online learning to impart teaching and to learn in both classroom and online environments. It is student-oriented and focuses on teacher–student interactions even after classroom sessions (asynchronous learning environments). It also motivates students to engage in self-directed studies rather than teacher-directed learning in traditional learning environments (synchronous learning environments). Moreover, blended learning environments characteristically provide a greater amount of flexibility to the teacher on what teaching methodology he or she wants to follow as well as to the student on how he or she wants to learn, in comparison to the traditional learning environments where teaching and learning flexibility is somewhat limited. There is a considerable amount of debate by researchers on the definitional adequacy of the terms "blended learning" and "e-learning" as synonymous or distinctive concepts [7–9]. However, due to its scope and nature of describing teaching and learning environments, the current paper does not elaborate on these distinctions and sticks to discussing technology-based learning environments under the umbrella term of "e-learning" while using "blended learning" as the current mode of e-learning practices.

In online learning environments, teachers and students use a web-based interface for teaching and learning. The course materials are made available online. Students interact with their teachers and peers through various online communication tools such as whiteboards, emails, chat rooms, bulletin boards, interactive videos, document-sharing systems, and instant messaging. Active interaction between teachers and students is a primary characteristic of e-learning practices. The teacher needs to ensure student engagement in a variety of online classroom activities, including critical reading, brainstorming sessions, debates and discussions, and question-response sessions. Compared to traditional classrooms, online learning environments provide more active platforms for teacher–student and peer interactions in synchronous and asynchronous situations that help students discard their hesitation and inhibition to participate in such activities [10].

1.2. Background

E-learning practices are common in Malaysian higher education. Technology-based teaching and learning strategies are mainly implemented to promote quality education [11]. However, these practices are relatively limited in language classrooms compared to traditional learning practices such as textbook materials, lecture-based teaching practices, and traditional classroom sessions. For example, virtual classrooms—online classrooms with a web-based interface for teaching and learning—are occasional in undergraduate programs. The practice of a smart classroom—either using the Internet of Things (IoT) [10] or virtual reality (VR) [12] can be effective in English language learning, particularly with respect to learner performance. But in the case of Malaysian ESL classrooms, it is still only partially

practiced. Moreover, the use of other online learning modes, such as blogs, flipped lectures, audio-visual learning content, and digital storyboarding, is limited to assignments, which is not always preferred by educators who prefer the traditional way of receiving them in print form. However, the student population is a community of 'digital natives' who prefer digitally driven learning environments [13]. Therefore, it is important that educators try to focus on implementing and integrating various e-learning strategies and practices into their teaching responsibilities. Researchers identified domains of e-learning strategies at great length [14–17], including social networking, language proficiency, reading comprehension, and vocabulary acquisition. The current study includes and addresses some of these domains.

In terms of operating and maintaining online learning environments, the role of a teacher or instructor is of significant relevance. The presence of a teacher in a virtual classroom is important for students, as they seek advice as well as educational and technological support from their teacher [18]. Therefore, it is important for teachers to possess the technical knowledge to use and practice advanced technologies for online learning. The use and practice of technology-integrated online learning may lead to several challenges. These may include factors like accessibility issues due to no Internet or a low budget, lack of instructor training leading to their inefficiency in technology use, negative attitudes of teachers and students on technology use, and lack of time and technical support [19]. This is further augmented by teachers' challenges, such as lack of social interaction and motivation, failure in online peer-to-peer communication, busy individual schedule, and technology problems [20,21]. More particularly, technology integration with language learning involves many challenges due to variations in students' and teachers' age, perceptions, attitudes, learning, and teaching styles [22]. Limited knowledge of technology affects not only teachers' pedagogical practices but also students' learning attitudes and motivation for online learning. Higher technology costs and limited Internet access can further demotivate language learners and teachers to utilize online educational tools. As language learning is primarily interactive in nature, online learning environments tend to make learners lose interest as well as motivation if direct communication with their peers or instructors is not possible [22]. These issues and challenges are important to understand and address, which can further impact the appropriate implementation of e-learning strategies.

In the context of English language learning through e-learning, teachers need to ensure that the amount of ESL courseware available online is sufficient and up-to-date for students to use. Using online courseware further requires the teacher to possess sufficient technological expertise to operate the teaching tools along with virtual classroom management, student engagement in online discussions and assignments, and use of multimedia devices and instructional design-based teaching tools and applications [18], which will eventually influence the students' language learning competency with a comprehensive understanding of the basic language skills. Most importantly, many students lack knowledge of constructive learning; therefore, teachers need to motivate them to develop their cognitive skills and gain subject competency, as in traditional classrooms. In other words, e-learning practitioners should facilitate, maintain, and enhance multi-faceted teaching strategies within the purviews of e-learning [18].

The current study focused on digitally driven English language learning in Malaysian higher education. Teaching and learning ESL in Malaysia goes back to the colonial period in the early 1930s when it was a concern only to a small literary elite class [23]. English was the medium of instruction in all national schools in colonial Malaysia and was given considerable prominence over vernacular languages. Post-independence (the late 1950s) witnessed the emergence of several issues, including national identity, communalism, and threats to national security, which resulted in the introduction of different instructional languages in the national curriculum at the primary level. As a result, Bahasa Melayu was declared as the medium of instruction in all national schools instead of English which, by the 1980s, remained only as a special subject taught in schools [23]. With this reduced use of the English language, the standards of spoken and written English declined. Toward the

beginning of the millennium, globalization powered by technological innovation became visible in the Malaysian economy, which demanded fluency in English. This further led to the resurgence of English while identifying the need for improving spoken and written practices of the English language with the urgency to compete on a global platform. In other words, globalization prompted English to reclaim its importance in Malaysian education. With digital advancements in education, e-learning applications and practices have become essential for an optimized learning environment in ESL. These further leverage innovation in e-learning strategies to make ESL learning more interactive and easily accessible.

2. Materials and Methods

The study discusses the applications of e-learning in pedagogical strategies for improving ESL teaching and learning efficiency through reviews of related literature and a longitudinal study of engineering cohorts. Technology innovation has made it easier for engineering undergraduates to develop language skills alongside their technical studies, preparing them for success in an increasingly globalized workforce. This makes integrating technology innovation and language learning more relevant, demanding educational authorities emphasize developing appropriate infrastructure and mechanisms and researchers to systematically investigate and analyze its various aspects and issues. One of the keyways that technological innovation has impacted language learning is through the development of online language learning platforms, apps, and tools for a better-personalized learning experience [24–26]. The current study mainly discusses implementing e-learning activities, including blogging, video making, online exercises, and digital storyboarding in the pedagogical practices (see Section 2.2). The primary aim of the study involves exploring the impact of e-learning activities on ESL learners': (a) writing competency, (b) reading comprehension, (c) vocabulary learning, (d) digital learning, and (e) overall learning experience. Reading and writing skills are highlighted in this study mainly because the syllabi of the chosen English language courses focus on these two competencies. The course objectives and learning outcomes aim at helping learners, the engineering cohorts, to be precise, in enhancing their specific language skills (proficiency in readability, comprehensibility, and writing). However, the scope of the study is limited to (1) two English language courses, (2) selected engineering students of one university, and (3) assignments and learning activities involving e-learning applications for the chosen language courses. Moreover, limited timespan is another aspect to consider, which directly affects the outcomes. Therefore, observations and investigations are based only on these limited choices, which further influences the results of this research.

The study adopted a longitudinal research design in which data is collected over an extended period, typically with multiple follow-up measurements taken at specific intervals. This approach allows researchers to track changes and developments in a particular group or individual over time and can be especially useful for investigating how variables or factors interact and influence outcomes [27,28]. It is a cohort study with qualitative and observational research and was conducted in a public university in Malaysia. For the review of related literature, the selection of previous literature was based on studies highlighting the following factors:

- Practice and challenges of e-learning in higher education;
- Implications of e-learning for improving English proficiency.

In terms of the cohort study, a public university in Malaysia was chosen with undergraduate students from various engineering programs. The study was conducted on the use and impact of e-learning activities to investigate their influence on English language proficiency in terms of writing competency and reading comprehension of the engineering cohorts in a 7-month longitudinal framework—from the beginning to end of both academic sessions in the same academic year (see Figure 1).

Longitudinal Research Design

Type

Cohort study

Duration

7 months (two academic semester sessions)

Methods

Qualitative, observational

Learning skills

Writing competency, readability and comprehensibility, vocabulary enhancement

E-learning activities

Blogs, videos, online exercises, digital storyboarding

Tools

Voyant Tools, Lumos Text Complexity Analyzer, Advanced Text Analyzer
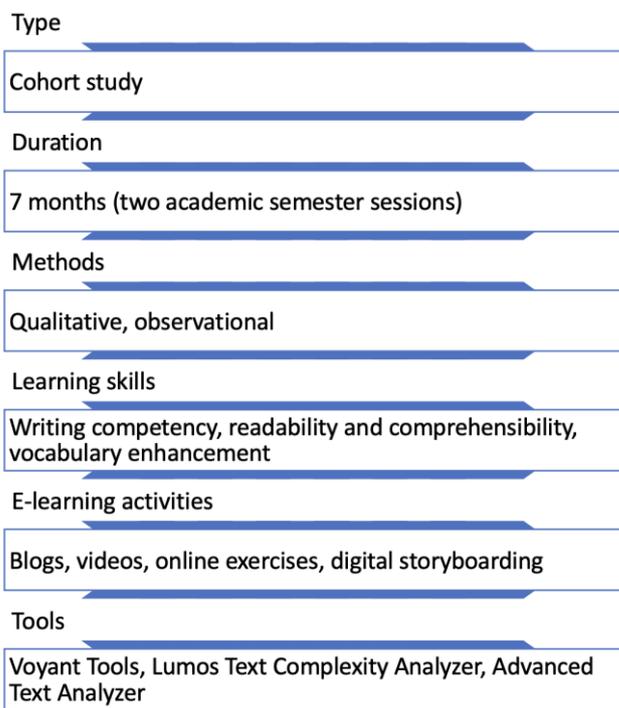
Figure 1. Research design.

2.1. Participants

Two hundred and twenty students pursuing various undergraduate engineering programs from first year (Semester 2) and second year (Semesters 3 and 4) participated in this study. The study covered two sessions of the same academic year (Semester 1 or the September intake and Semester 2 or the February intake) with students from two different English courses, English for Technical Communication (ETC) and English for General Communication (EGC). Each semester they comprised four classes of ETC and EGC courses. Further details of the participants are listed in Table 1.

Table 1. Participant details.

Semester 1 (14 Weeks)			Semester 2 (14 Weeks)		
ETC	**Student Year**	**Engineering Program (*n=*)**	**EGC**	**Student Year**	**Engineering Program (*n=*)**
Class 1	Sem 3	Electrical 1 (17)	Class 1	Sem 2	Mechanical 1 (13)
		Environmental (17)			Food Technology (12)
Class 2	Sem 2	Computer Network 1 (11)	Class 2	Sem 2	Industrial Biotechnology (11)
	Sem 4	Biosystem 1 (12)			Metallurgical (9)
Class 3	Sem 3	Manufacturing (14)	Class 3	Sem 2	Civil 1 (16)
		Material (15)			Mechatronic (15)
Class 4	Sem 2	Computer Network 2 (11)	Class 4	Sem 2	Mechanical 2 (14)
	Sem 3	Electrical 2 (10)			Civil 2 (10)
	Sem 4	Biosystem 2 (13)			
Total size		120	Total size		100

2.2. Tools and Processes

The study was conducted with engineering cohorts from two English language courses and included assignments and learning activities involving e-learning applications. The author was in the ESL teaching team (with four teachers). Following the coursework, students were assigned various digital tasks for their learning activities focusing on writing competency, reading comprehension, and vocabulary enrichment and appropriateness. The digital tasks included creating and developing blogs, videos on different social media platforms (Facebook, Instagram, and YouTube), online exercises (on Kahoot and other free educational web domains), and digital storyboarding (on their blogs or web pages). Learners were given clear instructions on creating and developing the digital content along with assessment details and grading rubrics of the assignments (both individual and group). Thus, the e-learning activities applied in the study involved blogging, video creation, online exercises, and digital storyboarding. The assignments and activities included the following:

- Blog content (group activity): create blog pages on any of the chosen topics of 'mental health', 'Internet of Things (IoT)', 'social responsibility', 'youth empowerment', and 'youth entrepreneurship';
- Video content (group activity): create videos on any of the chosen topics of 'effects of cross-cultural communication', 'student engagement in university life', 'social interactivity of students', 'languages and cultures', and 'benefits of a green campus';
- Online exercise (individual activity): attempt questions on common errors, sentence and fragments, facts and opinions, reading comprehension, and other grammatical elements discussed in classroom sessions;
- Digital storyboarding (group activity): create and develop a storyline in any chosen genre and characters with the detailed instructions provided by the teacher;
- Others (both individual and group activities): organize mock interview sessions, peer review, and discuss the outcomes.

Focusing on interactive learning practices, most of these activities were assigned in groups. Learners were instructed to peer review and share their learning experiences while updating course teachers on their progress and presentations. A scheme of work was outlined for students with weekly lesson and revision plans. These instructions helped not only the teaching team to administer and assess the activities but also learners to self-assess and peer review throughout the process. At the end of each academic semester, a sharing session was conducted where learners could provide their overall feedback and learning points (details in Section 3.7), which further helped instructors identify the issues and challenges of these e-learning applications. The teaching team further shared their individual experience with peers and other coursework-developing and teaching teams while highlighting the relevance of e-learning tools and activities in developing and practicing interactive learning environments.

The study primarily used three research tools for describing and analyzing data: Voyant Tools, Lumos Text Complexity Analyzer, and Advanced Text Analyzer. These are free web-based tools for reading and analyzing the complexity of a digital text and its quantitative features. Voyant Tools enables users to analyze and visualize large amounts of text data quickly and easily. It features word frequency analysis, topic modeling, and text mining that enable researchers in the humanities and social sciences to gain insights into language patterns, authorship, and textual trends [29,30]. In the context of Lumos Text Complexity Analyzer (www.lumoslearning.com, accessed on 17 December 2022), it helps teachers and curriculum designers select texts appropriate for students at different reading levels. The tool uses a range of linguistic and statistical measures to analyze the complexity of a text, including word frequency, sentence length, and vocabulary difficulty. For researchers studying literacy development and reading comprehension, this tool provides a standardized measure of text complexity that can be used across different texts and populations. Advanced Text Analyzer is a valuable tool for researchers looking to gain insights into large text datasets quickly and accurately [31,32]. Its analytical features, automation, consistency, and flexibility make it a powerful tool for any research project

that involves analyzing text data. All the tools were implemented to generate statistical results of the collected data in terms of word frequency trends, vocabulary density and uniqueness, and grammatical appropriateness, among other related aspects.

2.3. Ethical Considerations

2.3.1. Ethical Approval

The current study was conducted with the students of two English language courses taught at a Malaysian university. It collected completely anonymized digital data from these courses, mainly from the digital assignments given out by the researcher as part of the teaching team. The collected data comprises content from blogs and online exercises created by the researcher and submitted by the students, under their assigned group names, and without personal details, as part of their learning activities following the coursework. In terms of conducting the sharing sessions, the researcher provided participants with open-ended questions to prepare possible answers for the sessions. During the sessions, the researcher noted down participant experiences and retrieved summarized feedback from those sessions. The current study includes all the data collected for it. The study did not seek any approval for ethical considerations as it did not address or include any personal information or sensitive data of the participants. Its results and discussion contain all the data collected.

2.3.2. Informed Consent

The study collected data from the specific assignments and activities clearly instructed to them by the teaching team of the chosen courses. All participants gave their verbal informed consent upon the assurance that all data were fully anonymized. Moreover, the data is collected from their blog pages, available online in the public domain for everyone to visit. In terms of data collected from the sharing sessions, the study included anonymized details rendered by the researcher based on the shared details. It mainly included participants' first-hand experience and overview of the e-learning implementation throughout their academic sessions.

3. Results and Discussion

The use and implementation of e-learning play a significant role in Malaysian higher education. Online learning is currently implemented across Malaysian universities while providing a blended mode of teaching and learning in various undergraduate, graduate, and postgraduate programs. With the increasing demand for digitally driven higher education, most Malaysian universities and institutes are engaged in developing various e-learning programs and courses operated and organized through different LMSs and developing strategic plans for e-learning integration in teaching and learning both in their regular and distance curricula. The Ministry of Education Malaysia is investing significantly in developing various e-learning delivery and management systems in higher educational institutes. The current online learning environment in Malaysian higher education witnesses a remarkable advancement in integrating information technology into higher education, indicating the emergence of a whole new generation of technically knowledgeable teachers and learners [17,33–35]. Notably, the field of teaching and learning English as a second language has been significantly transforming e-learning environments in Malaysian higher education [17,35]. However, there is a variegated observation on aspects of integration of e-learning practices, actual preferences of the educators, and the overall scenario of the e-learning environments in Malaysia (see the Background section). The discussion below looks at these aspects in greater detail.

The cohort study of 220 engineering undergraduate students was organized over seven months in two consecutive academic semesters, with the ETC course of 120 students in Semester 1 and the EGC course of 100 students in Semester 2. The study reported the outcomes in the specified learning components of writing competency, reading comprehension, and vocabulary enrichment and appropriateness. In addition, students were

also graded for their digital content, including blogs, videos on different social media platforms (Facebook, Instagram, and YouTube), online exercise (on Kahoot and other free educational web domains), and digital storyboarding (on their blogs or web pages). Due to the limitations of the study, the outcomes address and highlight results specifically from the aspects of assessment content and learning activities. The details of these outcomes are presented below.

3.1. Writing Competency

Given the availability and accessibility of advanced technology for social interaction and pedagogical learning increasingly implemented by various academic programs and institutions, the role of e-learning can be crucial for gaining educational knowledge in general and enhancing language proficiency in particular. Researchers have studied the implications of e-learning strategies to acquire and improve English language proficiency and learning skills [36–38]. In terms of developing ESL proficiency, e-learning strategies can be developed and implemented to improve all aspects of basic language skills, including writing competency, reading comprehension, and vocabulary acquisition. While technology-driven education can increase student engagement, it can help learners identify their conceptual (course-related terms) and structural (grammatical terms) doubts and errors, revise, and improve their writing proficiency and overall performance [39]. The current study reported the following observations on the structural and semantic appropriateness of using ESL in terms of writing competency:

- Quotation marks: Cohorts used fewer quotation marks in their digital content, particularly in developing blog topics and online exercises, which demanded thematic elaboration. Instead, they used more paraphrased sentence structures to support their views and argumentation.
- Colons and semicolons: Cohorts showed lesser use of colons and semicolons in sentence structures, indicating their attempt to use less complex sentence structures so that meaning is delivered precisely. However, this somewhat pinpoints their hesitation about trying to understand and practice the complexities of lexical and semantic structures as advanced-level ESL users.
- Lexical density: The study showed the use of more words per sentence in learners' content. In other words, cohorts wrote longer sentence structures across their digital content of blogs, online exercises, and storyboarding. However, that does not necessarily indicate their use of complex sentence structures.
- Syllabic structure: Cohorts used shorter words relatively more than words with more syllables. This showed simple use of vocabulary and less or no use of complex synonyms. While it makes the write-up comprehensive and easy to read, it fails to show the advanced comprehension level of learners, which is expected of them.

Table 2 summarizes ESL learners' use of lexical, syntactic, and semantic appropriateness in blogs based on their blog content.

In terms of creating and developing the digital storyboarding content, results showed (in Figure 2) extensive use of the vocabulary of longer syllables and academically inclined synonyms that can be appropriately used for creative content writing. This supports the observation that digital storyboarding was a preferred choice of the cohorts for learning writing to improve writing competency. In addition, students found it an interactive and engaging tool to learn and practice vocabulary usage as they were assigned tasks of developing a storyline and creating new characters along with the plot. Hence, content creation for digital storyboarding became more of an engaging activity for students than the content of blogs and other assigned activities.

Table 2. Text Statistics for Blog (Source: Lumos Text Complexity Analyzer).

General			Punctuation	
	Overall	**Sampled**		**Overall**
Words	2705	101	Periods	139
Different words	928	70	Commas	118
Sentences	114	5	Quotation marks	12
Characters (all)	16,443	610	Apostrophes	20
Characters (a–z only)	13,395	498	Colons	2
Syllables	4571	168	Semicolons	2
Syllables per word	1.7	1.7	Question marks	1
Characters per word	5.0	4.9	Exclamation marks	0
Standard deviation of word length	2.7		Dashes	11
Words per sentence	23.7	20.2	Parentheses	4
			Brackets	0
			Braces	0

Figure 2. Word cloud for storyboarding (Source: Voyant Tools).

Moreover, learners were observed to be using unique and unusual words in their online exercise content, which were mostly either culture-specific words or complex synonyms of regularly used words. Table 3 summarizes this observation.

However, grammatical issues were apparent in their content, specifically in using tense and number, relative clauses, complete sentences, parallelism, verbs, and prepositions. Some examples are shown in Table 4. In addition, word appropriateness and cohesion were concerns that learners tended to overlook at times while attempting to produce meaningful sentences or paragraph constructions. This was apparent in their blog content as well. Previous studies [17] reported that Malaysian bloggers use varied sentence structures and take care of stylistics, punctuation, and spelling errors, but with relatively less focus on the correctness of grammatical structures. This aligns with the results of the current study.

Table 3. Text Statistics for Online Exercise Content (Source: Advanced Text Analyzer).

Text Analysis Summary		Text Statistics	
Word count	508	Character count	2777
Average word length	6	Word count	508
Average sentence length	19.5	Sentence count	26
Syllables per word	1.8	Syllable count	938
Words per paragraph	20.3	Unique word count	249
Sentences per paragraph	1	Paragraph count	25
Text Density Issues			
Characters per word	6		
Words per sentence	19.5		
Sentences per paragraph	1.0		
Syllables per word	1.8		
Words per paragraph	20.3		

Table 4. Grammatical Issues for Online Exercise Content (Source: Lumos Text Complexity Analyzer).

Text Excerpts	Grammatical Issues
Discuss about the	Collocation error discuss the
Help	Possible agreement error helps
Complain for	Collocation error complain about
Gave	The verb after "to" should be in the base form: "give" give
Are	Possible agreement error is

3.2. Reading Comprehension

E-learning can be effective in improving the reading skills of ESL learners. Reading activity demands students' engagement and active participation in comprehending and responding to the reading content of a text. Reading activities in the English language focus particularly on meaning comprehension, language learning, and fluency development. Using e-learning strategies for teaching the reading process can help develop learners' positive attitudes toward reading, achieve cognitive goals of the reading text, identify the main idea, and infer specific information [40]. The research further discussed several e-learning strategies that can be effectively applied in teaching reading skills:

- pre, during, and post-reading activities of predicting, answering, and synthesizing the content of a reading text;
- reading objectives of building prior knowledge, developing a positive attitude toward reading, achieving reading comprehension, and integrating reading skills with other basic language skills;
- reading materials such as pictures, audio, video, web pages, comprehension questions (short answers, multiple choice questions), and reading text;
- e-learning web tools such as files, URLs, pages, chats, forums, and assignments as online and offline activity.

The current study included most of these strategies (or rather activities) in assignments and exercises, which were then discussed in peer review sessions during the semesters, along with sharing and feedback sessions organized at the end of academic sessions. In the case of blog writing, cohorts used complex synonyms and long words to a limited extent. However, their readability levels showed average readability scores at the college graduate level.

As listed in Tables 5 and 6, Gunning Fog Index, Coleman–Liau, Automated Readability Index, Flesch–Kincaid, Lasbarhets index, FORCAST grade, Powers–Sumner–Kearl Grade, and SMOG grade are readability metrics applied for checking and measuring learners' ease of readability, comprehensibility, and difficulty levels of understanding a text based on word length, sentence length, and the number of syllables. These metrics were mainly developed for gauging students' readability and comprehensibility levels of English texts across US educational systems and can be carried out in any language [41,42].

Table 5. Readability for Blog (Source: Advanced Text Analyzer).

	Overall	Overall Grading	Sampled	Sampled Grading
Hard words	489		13	
Long words	687		22	
Lexical density	34.31%		69.09%	
Lexical density (Without stop words)	53.90%		55.61%	
Gunning Fog Index	16.72	College senior (11 years)	13.96	College freshman (8 years)
Coleman–Liau grade	12.07	High school senior (7 years)	11.65	High school junior (6 years)
Flesch–Kincaid grade level	13.60	College freshman (8 years)	12.46	High school senior (7 years)
Flesch reading ease	39.79	Very difficult: College graduate	44.45	Very difficult: College graduate
ARI (Automated Readability Index)	19.06	Postgraduate (14 years)	12.59	High school senior (7 years)
SMOG grade	14.96	College sophomore (9 years)	12.54	High school senior (7 years)
LIX (Lasbarhets index)	49.13	Medium, normal newspaper text	43.14	Medium, normal newspaper text

Table 6. Readability Statistics for Online Exercise Content (Source: Lumos Text Complexity Analyzer).

Readability Grade Levels		Readability Scores	
Flesch–Kincaid grade level	13.8	Readable rating	D
Gunning Fog Index	16.7	Flesch reading ease	30.8
Coleman–Liau Index	14.8	CEFR level	B2
SMOG Index	16	IELTS level	5–6
Automated Readability Index	14.1	Spache score	5.5
FORCAST grade level	12.2	New Dale–Chall score	7.8
Powers–Sumner–Kearl Grade	7	Lix readability	53
Rix readability	12	Lensear write	58.9
Raygor readability	13		
Fry readability	0		

As shown in Table 6, cohorts showed a readability rating of D with average grades and a B2 level in CEFR (Common European Framework of Reference for Languages—an international standard for scaling learners' language ability) for the online exercise content. Thus, in terms of reading comprehension, learners attempted somewhat complex levels of lexical compositions but could achieve only an average readability level. This reasonably calls for further research and investigation of a comparative readability analysis

of traditional and digital learning content, which is beyond the scope of the current study. Moreover, it unlocks the scope for exploring reading trends, and practices learners prefer to improve comprehension, interpretation, and fluency [13], which is again beyond the inspective extent of the current study.

3.3. Vocabulary Enrichment and Appropriateness

Vocabulary acquisition is one of the primary concerns for English language learners. Knowledge and use of vocabulary in a language influence its basic learning skills. Therefore, it is important to develop effective learning strategies, methods, and tools to improve vocabulary knowledge and use. To improve English vocabulary, various vocabulary learning strategies can be developed, including a serial approach (from easy to difficult level) to learn target words, a preference approach (word card, flash card, Chinese assonance, antonym, synonym, imagery, grouping, and clipping), Internet dictionary, and traditional paper-based dictionary [38]. Learners tend to find e-learning-based vocabulary learning strategies more convenient than traditional classroom drills and memorization techniques for improving and retaining vocabulary knowledge. Moreover, online resources are one of the preferred ways for students to learn and understand the meaning of new and difficult words [13]. In other words, learners prefer and practice technology-driven vocabulary learning strategies, which was also reported in the current study. Results from the digital storyboarding content of the current study showed that students used a wide range of vocabulary to create and develop their stories. Figure 3 displays the high frequency words used in students' storyboarding. They also experimented with various genres including suspense, thriller, tragedy, romance, melodrama, horror, and science fiction (zombie and alien). Further, these experiments provide significant room for exploring genre interactivity in e-learning environments.

Figure 3. High Frequency Words in Storyboarding (Source: Voyant Tools).

As shown in Figure 4, long words and unique words were relatively frequent in the storyboarding content.
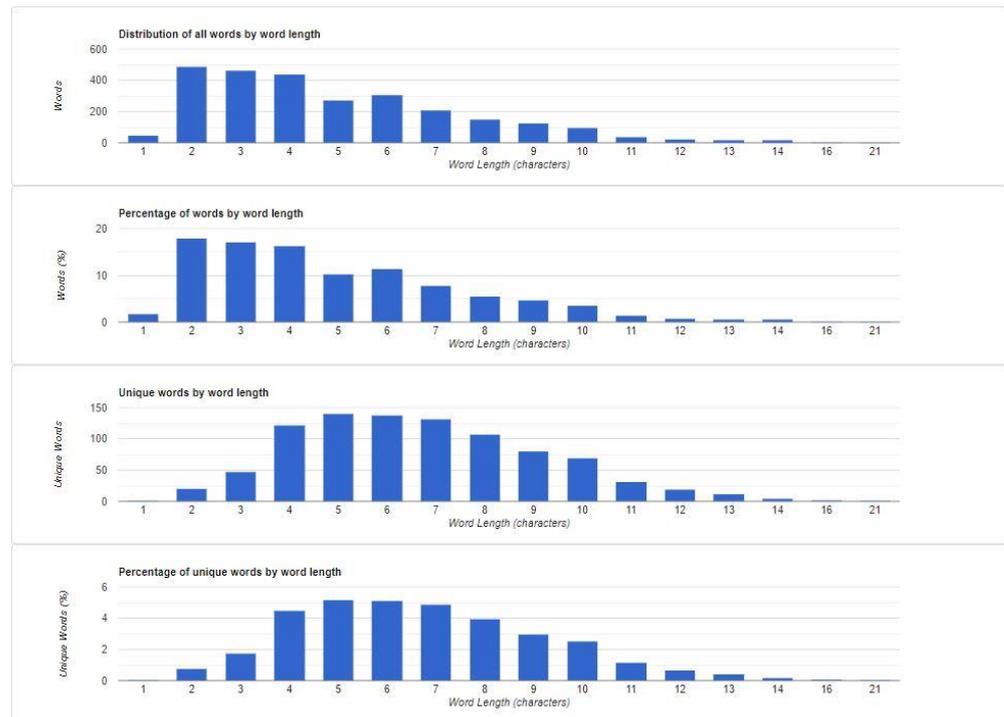
Figure 4. Word Length in Storyboarding (Source: Advanced Text Analyzer).

The content of online activities showed complex words with longer syllables. For example, there were long sentences with more than 20 syllables across the online content. Table 7 summarizes this observation.

Table 7. Word Statistics for Online Activity and Video Content (Source: Advanced Text Analyzer).

Possible Lazy Words			
That, every, give, great, very, work, big, type, important			
Possible Adverbs		**Possible Profanity**	
Very, frequently, sometimes, also		Gods, screw, burnout, addiction	
Hard Words			
Consequences	More than 4 syllables	Appropriateness	More than 4 syllables
Revolutionized	More than 4 syllables	Globalization	More than 4 syllables
Communication	More than 4 syllables	Evaluation	More than 4 syllables
Multicultural	More than 4 syllables	Organization	More than 4 syllables
Environmental	More than 4 syllables	Opportunity	More than 4 syllables

3.4. Blog Creation

With blogs becoming one of the popular tools of communication among younger Malaysians, their utilization of learning is the need of the hour. Teaching and learning ESL through blogs can be quite effective as blogs serve the prerequisites of online learning, particularly in a virtual classroom. Blogs provide a relevant domain for the virtual formation of speech communities, knowledge sharing, and various sociolinguistic practices such as code-mixing and code-switching [17]. Blogs are also used as a platform for discourse learning, vocalizing public opinion, and identity building by practicing code-switching and code-mixing—sociolinguistic features—by learners in Malaysia [17]. As Malaysians witnessed the deterioration of the standard use of English in the late 1990s, the variegated forms of code-switched and code-mixed "Manglish" (a combination of Malay and English) emerged [17]. The current evolution in blogging in Malaysia also witnesses an increased

use of topic-specific jargon. Table 8 displays students' use of such vocabulary in blogs while Table 9 summarizes their frequency. Since blogs usually leave adequate room for bloggers' interests and views, readers' opinions and comments, and informal discussions related to any matter or subject, blogs can act as a dynamic platform for nurturing intellectual and pedagogical environments. The current study reported the presence of sociolinguistic features like the use of colloquial vocabulary and structures along with other cultural contexts in learners' content. Code-mixing is a common sociolinguistic phenomenon practiced by the engineering cohorts in the current study, which was also apparent in their digital storyboarding content (see Table 10). The cohorts are the younger Malaysians who are bilingual and multilingual speakers and tend to frequently use code-switching and code-mixing in a blogger–audience interaction [17]. Further, writing a blog requires compositions with varied sentence structures, correct punctuation and spelling, and mixed codes, which means the blogger must have a certain level of English proficiency. Thus, using blogs as a pedagogical tool for teaching and learning ESL can be quite effective and efficient for online learning.

Table 8. Hard Words for Blog (Source: Advanced Text Analyzer).

Word	Count	Length	Syllables	Pct_Total	Tf_Weight
Media	14	5	3	0.52	1
Responsibility	14	14	6	0.52	1
Travelling	7	10	3	0.26	0.75
Environment	6	11	4	0.22	0.71
Awareness	4	9	3	0.15	0.64
Psychotherapy	3	13	5	0.11	0.61
Communication	2	13	5	0.07	0.57
Influenced	1	10	3	0.04	0.54
Initiatives	1	11	4	0.04	0.54
Backyard	1	8	3	0.04	0.54
Tradition	1	9	3	0.04	0.54

Table 9. Word Frequency Analysis for Blog (Source: Advanced Text Analyzer).

Word	Count	Length	Syllables	Pct_Total	Tf_Weight
Social	31	6	2	1.15	0.65
Responsibility	14	14	6	0.52	0.57
Working	11	7	2	0.41	0.55
Mental	10	6	2	0.37	0.55
Culture	8	7	2	0.3	0.54
Community	6	9	4	0.22	0.53
Impact	5	6	2	0.18	0.52
Friends	3	7	1	0.11	0.51
Indigenous	2	10	4	0.07	0.51
Motivate	1	8	3	0.04	0.50

Table 10. Collocal Vocabulary and Expressions in Storyboarding.

Storyboarding Excerpts	Specificity
Jerry grabbed Aliyah arm and walk away from Derek. Suddenly "Krakk" a sound of glass break.	Use of native (Malay) language ("Krakk")
Suddenly the door in the room opened slowly. Krrrrrkkkk kedegangg. The door was closed	Use of native (Malay) language (Krrrrrkkkk kedegangg)
In the next morning, they woke up at a late morning. Aliyah parent bought them some *nasi lemak* and *roti canai* for brunch.	Names of local (Malaysian) cuisine (*nasi lemak* and *roti canai*)
"You're lying I hate all of you especially you Aliyah!!" 'Pangg' Suzy slapped Aliyah. Aliyah feel sad and shocked.	Use of native (Malay) language ('Pangg')
According to Pak Cik Badrul, his children initially disagreed with his decision to become a Grab driver because he would need to travel back and forth to Kelantan every two weeks.	Use of native (Malay) honorific address form (Pak Cik)

One of the latest developments in blogging is video blogs or vlogs [43] through which video clips are broadcast, encouraging audience response at a larger scale. In terms of pedagogical methodologies, the increased practice of blogging has opened a wide assortment of e-learning pathways for teachers and learners to develop and implement. Vlogs can be used as an appropriate substitute for virtual classrooms and regular online postings and discussions related to ESL teaching and learning. The practice of blogging can effectively lead to instilling critical and creative thinking in learners while improving their analytical writing skills in particular and self-directed learning as a whole, along with enhanced social interaction [44–46]. The current study demonstrated these features in the videos created on different social media platforms, including YouTube, blogs, and other educational websites. Using social networking sites as a popular mode of communication has resulted in the increased practice of social interaction. The rapid growth of the online network has remarkably transformed the meaning of interpersonal relationships with an evident shift to the use of social networking sites, which outspreads to a considerable extent over other professional domains in Malaysia, including academia. Interaction-based features used in social networking sites help users address issues like falsification of identity, security threats, and freedom of expression. At the same time, they can manage and control their social profile per their preferences and interests [34]. Further, this helps users specify the purposes and priorities of their social interactions. Young and techno-savvy social media users are relatively more aware of these issues than the older generation. Enlarging the circle of socialization is primarily motivated by peer interaction, which further influences the development of social skills such as leadership, cooperation, dominance, negotiation, and compromise [34]. Social media offers various interactive activities. Facebook, a popular social networking site, supports several interactive features such as group discussion, message and image posts, and event organization. Social communication provides an interactive platform for teachers and students to share, exchange, and improve their knowledge and learning strategies. In terms of imparting education through digital social communication, these interactive social media features can be quite effective and interactive while aiming at improving social skills and behavior as well as pedagogical knowledge and self-directed learning. The current study reported that the cohorts chose various topics for their vlogs, demonstrating their interest and perceptions through their opinions and views. The blog content of the cohort study reported the use of long words frequently.

3.5. Digital Storyboarding

Digital storytelling is one of the recently developed practices integrated into technology-driven learning environments. Its primary objective is to tell stories and make and convey

meaning using various digital technologies, including computers, digital cameras, video recorders, and podcasts. As a pedagogical practice in learning ESL, digital storytelling can be utilized to improve learners' writing competencies [47]. Further, the current study reported that the practice of digital storytelling could also be used to enhance other linguistic aspects such as vocabulary knowledge, usage and appropriateness, code-mixing, and grammatical and structural cohesiveness. Code-mixing is common in students' discourse across Malaysian universities since such interactions occur among learners from different sociocultural, ethnic, and geographical backgrounds. This is commonly practiced in writing as well, and it was particularly observed in ESL classrooms. The use of code-mixing in their digital storytelling content opens considerable scope for further research into linguistic systems addressing multilingualism and multiliteracies [48], which is beyond the scope of the current study.

The results from the digital storyboarding content in the current study showed that cohesion was maintained or at least attempted across sentence structures and word correlativity, as shown in Table 11.

Table 11. Correlational Significance for Storyboarding (Source: Voyant Tools).

Term 1	Term 2	Correlation (*r*)	Significance (*p*)
Bought	Old	0.98	1.43
Began	Face	0.97	2.58
Immediately	took	0.97	3.96
Asked	suddenly	0.95	3.16
Dawn	going	0.95	3.58
Grab	reminded	0.94	6.37
Entering	house	0.93	8.84
Accident	living	0.93	9.50
Decided	gangs	0.90	0.00
Hit	including	0.22	0.54
Accident	media	0.21	0.57
Come	face	0.18	0.62
Just	realized	0.17	0.65
Eyes	fact	0.16	0.67

While digital storytelling is still recent compared to other e-learning techniques to be integrated into education or language learning to be specific, it can improve problem-solving, creativity, perspective building, and higher-order thinking [49].

3.6. Online Exercise Content

Students were instructed to exercise and attempt quizzes on Kahoot, crosswords, and multiple-choice questions (MCQs) on various educational platforms designed mainly to check and improve their English writing competencies. Students learned the appropriateness of using different grammatical elements through these exercises. The results showed that nouns were the most used grammatical element, followed by adjectives, prepositions, and verbs. Table 12 summarizes this observation.

Table 12. Text Composition for Online Exercise Content (Source: Lumos Text Complexity Analyzer).

Grammatical Elements	Count	Grammatical Elements	Count
Adjectives	65	Nouns	189
Adverbs	9	Proper nouns	7
Conjunctions	39	Pronouns	18
Determiners	55	Qualifiers	0
Interjections	1	Verbs	63
Prepositions	65	Unrecognized	5
Non-words	0		

Cohorts also learned the practice of self-study. Since the nature of these online exercises was mostly self-directed, students became familiar with the practices of self-managing, monitoring, and modifying the content they created and developed for the assigned activities. In other words, the adapted e-learning practices for online exercises helped students identify their conceptual and structural doubts and issues while working on resolving them. This further helped students improve their writing competencies.

3.7. Sharing Session Outcome

Technology-driven learning strategies levitate students' learning process in terms of skill development and innovative technology implementation via access to information and emerging technologies [11]. This is in line with the output of the feedback-sharing sessions in the current study, which cohorts reported at the end of the selected academic sessions. During these sessions, learners were provided with a list of questions specifically intended to acquire their responses on a variety of aspects. Cohorts were instructed to prepare their responses to these questions and share their specific feedback on various things addressing the course content, learning approaches used during the semesters, and their experience and learning while developing content for the selected assignments and activities. The list included the following open-ended questions:

- Assessment content:
  - Which assessment content did you enjoy preparing the most: Blogs, video-making, digital storyboarding, mock interview sessions, peer reviews, or online exercise?
  - Prepare your response on the reason(s) why you liked it the most.
  - Prepare your response on how you executed it.
- Learning approach
  - While preparing the content, which mode of study did you prefer: self-study, group-study, self-assessment, or peer review?
  - Prepare your response on the benefits of your chosen mode of study.
  - Prepare your response on the outcomes of your chosen mode of study.
- Overall experience
  - What did you learn from each of these assessment types?
  - Prepare your response on any challenge/issue you faced during the preparation and execution of these assessments and activities.
  - Prepare your response on how you managed to overcome those challenges/issues.
  - Prepare your response on your learnings from the individual and group activities.
  - Prepare your response on how these learnings will help you in future.

Moreover, cohorts were given clear instructions on how to proceed with the sharing session and what kind of questions they could and should possibly discuss and exchange their views on. This helped not only the students in learning through a technology-driven

environment but also their teachers in identifying the shortcomings and improving their teaching process. The study used only the summarized details of the participant feedback, which the researcher noted during the sessions and prepared. The detailed feedback of these sharing sessions is summarized below.

- Learning interactivity: Cohorts found e-learning-based learning environments more interactive than their traditional mode of learning. Students could interact with their teachers and peers more frequently through synchronous and asynchronous modes, which further helped them discuss and work together on a variety of topics, including their individual and group assignments and activities and discussions with their educators on the understanding of the instructions selected for the current study.
- Innovative technology implementation: Students found digital and social media applications more convenient and easier than traditional learning approaches for their learning process. Learners felt that they could now access information online or utilize social media platforms more explicitly than ever for education in general and for enhancing their linguistic knowledge of English in particular. For example, cohorts informed of using various online applications, such as free online grammar checker, paraphrasing, and proofreading tools like Grammarly, Ginger, Typely, and ProWriting Aid and other in-built language and spell check features on blog sites, for grammatical and structural correctness of the content they created and developed in their blogs and digital storyboarding. Further, innovative technologies motivated learners to self-assess and peer-review the assigned activities, which became a regular practice and learning strategy in other courses. Constant exchange of feedback and suggestions with peers and teachers helped students remarkably improve their learning process.
- Learner engagement: Cohorts shared that their learning engagement improved considerably using e-learning applications. They became more focused as they could now utilize their familiar technologies and/or emerging digital tools and applications in their learning process. Furthermore, as these sharing sessions demanded elaborate answers to a specific checklist provided by their teachers, students could easily note their progress and prepare their feedback simultaneously while learning during the semesters. In other words, e-learning applications helped cohorts develop a profound interest in their learning, improving their understanding and argumentative analysis of topics while contributing remarkably to the overall quality of education [11].

The findings of this study thus emphasize the need for more frequent use of digital learning content for enhanced learning skills and an overall learning experience.

4. Conclusions

The current study explored and discussed (a) the dynamism in technology innovation and language learning strategies and (b) the integration of the two in pedagogical practices, particularly in ESL classrooms, by implementing various e-learning activities. The research outcomes further contribute to the existing body of literature addressing these aspects. A blend of technology and learning is very effective for language teaching and learning. The global perspectives of the English language have made ESL teaching and learning a relevant requisite and highly beneficial through different online tools and technologies. Higher education in Malaysia has already witnessed the practice of online learning, which has incorporated and expanded over newer domains such as blogging and social media. Such e-learning applications can develop effective pedagogical systems for teaching and learning various language skills. The current study incorporated various e-learning activities as part of teaching ESL to engineering undergraduates. Results showed that e-learning-based ESL teaching and learning practices could be quite effective in terms of improving language proficiency and particularly enhancing reading comprehension and vocabulary acquisition. The study examined the suitability of using ESL in writing competency and found that participants used fewer quotation marks and less complex sentence structures in their digital content but wrote longer sentences. Participants tended to use simpler vocabulary and shorter words, which made their writing easy to read but did not demonstrate their ad-

vanced comprehension level. The study found that participants extensively used advanced vocabulary and longer words with multiple syllables when creating digital storyboarding content, which helped improve their writing competency. Digital storyboarding was found to be an engaging tool for learners to learn and practice vocabulary usage while developing storylines and characters. However, learners had grammatical issues with their content, specifically with tense, number, relative clauses, complete sentences, parallelism, verbs, and prepositions. They sometimes overlooked word appropriateness and cohesion when attempting to produce meaningful sentences or paragraphs, which was also apparent in their blog content.

In terms of teaching reading skills, the study included various e-learning activities of [40] in learner assignments and exercises, which were later discussed at length in the feedback-sharing sessions. Results showed that the cohorts tried to use some complex vocabulary and long words in blogs and online exercises to a limited extent, but their writing only achieved an average level of readability with an average score (measured through various readability metrics) at a college graduate level. Therefore, it is necessary to conduct further research and compare the readability of traditional and digital learning materials. Additionally, this study suggests a need to explore learners' reading preferences and practices to improve their comprehension, interpretation, and fluency. Finally, the study found that students used diverse vocabulary and experimented with different genres such as suspense, thriller, tragedy, romance, melodrama, horror, and science fiction, including zombies and aliens, in their digital storyboarding content. These experiments suggest opportunities for exploring genre interactivity in e-learning environments. This, in a broader context, evidently makes way for further research and more systematic inquiries into the relevance of digital learning in general and emerging educational technologies, in particular in knowledge gain, exchange, and transfer in education as well as in specific skill development and capacity building not only for learners but also for educators.

The importance of English as a global language of communication is rapidly growing with the increased practice of globalized and integrated economies, thus identifying the knowledge of English as an essential requirement in academia, businesses, and organizations. As an instrumental language necessary for competing in the global economy, English plays a critical role in a wide array of professional and personal domains, including higher education, corporate and professional training organizations, businesses, and markets [23]. Therefore, it is significant that more research on the usability and optimization of English across disciplines and sectors is explored. While Malaysian organizations aim to compete and flourish in the international economy, they consider spoken and written forms of English as essential prerequisites. Hence, acquiring the appropriate knowledge and expertise through education is relevant. This further necessitates the integration of e-learning strategies and practices with traditional learning modes to make learning more interactive and effective. Certain factors associated with e-learning techniques require serious investigation to achieve effective learning. For example, students accustomed to face-to-face interaction in traditional classrooms may find it difficult with online learning, leading to difficulty understanding their academic needs and pedagogical attributes of education [50]. Since advanced technology is generally used in e-learning, training in teaching and learning techniques is essential for ESL teachers and students. Moreover, academic authorities should pay special attention to factors like the availability of resources, organization and management of e-content and virtual classrooms, and knowledge of information technology.

Active learner engagement and interaction are crucial in any e-learning program. Therefore, encouraging students to student–teacher and peer interaction regarding content comprehension is an essential responsibility of a teacher, initiated in the current study through the creation and development of blogs and digital storyboarding, and feedback-sharing sessions. Further, immersive technologies, like Metaverse, can significantly influence learner engagement and interaction, which requires future research directions. As advanced technology is the key to effective e-learning, teachers need to be well-equipped

with technology knowledge and use. They need to regularly review instructional materials and technologies used in online learning while upgrading their knowledge to meet the program standards and improve students' learning proficiencies.

Although online learning is available anywhere, students need motivation in the classroom for such learning. The ESL teacher can be instrumental here. Since motivation plays a crucial role in online learning, students' lack of motivation should be studied in a more organized manner to identify its causes and effects. This will further help the ESL teacher identify specific e-learning strategies and techniques. In addition, learners and teachers must ensure Internet accessibility to successfully accomplish the objectives of online learning. With the emerging technologies every day, advanced e-learning tools and applications will be instrumental and effective for more interactive education in the coming days. While e-learning has redefined some strategies and concepts of subject knowledge and proficiency, teaching/learning techniques, and styles, it has enabled both learners and the teaching community to explore, understand, and perform better.

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