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Development of a Sustainable Web Application for a Blended Learning Environment to Improve Standardized English Test Performance of Undergraduates at King Mongkut's University of Technology North Bangkok, Rayong Campus

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Article information	
Abstract	English proficiency tests are now being required by many universities in Thailand to benchmark students' language proficiency and to prepare students for their future work. However, students continue to underperform despite compulsory English coursework. Even though English courses are compulsory at KMUTNB, our undergraduates are struggling to achieve the desired score in standardized English tests such as TOEIC or K-STEP. Such performance has led to losing employment opportunities or postgraduate study. Consequently, this mixed-method research aims to study the effectiveness of a web application via a blended environment to improve reading and listening skills. A complimentary English course through a web application and Zoom classes for eight months was offered to 100 non-English majors. The results were positive in terms of test achievement, increasing scores in both the listening and reading parts. In addition, satisfaction with the web application was highly rated, suggesting satisfaction. Nevertheless, the attendance rates, both on the web application and Zoom, were decreasing considerably as time went by, raising issues of self-regulated learning. While the web application demonstrated technical feasibility and positive user perception, findings suggest that free voluntary courses may be insufficient for improving language skills without adequate motivational support systems, such as structured guidance, regular feedback, and community engagement to enhance learner motivation and commitment.
Keywords	blended learning, web application, receptive skills, EFL undergraduates, self-regulated learning
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1. Introduction

Receptive skills, reading and listening, are crucial for professional and academic success in an international setting. Whether students want to pursue their career or continue their study, they need to be able to read and listen in English. While there are two compulsory English courses offered at King Mongkut's University of Technology North Bangkok (KMUTNB) for all majors, students consider it challenging to maintain the skills until their fourth year. This low proficiency has clearly shown in their low score in standardized English tests, TOEIC or K-STEP. Consequently, they might not be able to obtain accepted by a company or continue their study. Ferris and Tagg (1996) reminded us that listening and reading are primary language barriers between native and non-native speakers. Therefore, they can be quite challenging for language learners. In discussing the difficulty of listening skills, Buck (1992) supports the notion that cultural distinction, connected speech, and idiomatic expressions can hinder successful communication. Moreover, as learners cannot repeat real-time listening comprehension, the lack of repetition makes it even more challenging compared to reading (Ferris & Tagg, 1996). Some scholars have explored a few studies regarding the English proficiency levels of Thai students, revealing remarkably low levels, especially in their TOEIC and IELTS tests (Bolton, 2008; Wiriyachitra, 2002). This phenomenon has embarked on the reformation of English language teaching and learning in higher education (Khamkhien, 2010; Wiriyachitra, 2002).

This study also concerns the challenges that students might encounter in strengthening their receptive skills; the course has applied blended learning, which combines face-to-face meetings and self-online learning. The method offers several benefits to Thai students. For example, the study by Sharma and Barrett (2007) suggests that the blended-learning approach promotes flexibility, allowing everyone to learn and engage with learning materials at their own pace. In so doing, the students can revisit the lessons and repeat exercises that enhance their understanding of language patterns, cultural differences, and idiomatic expressions. Other studies also reveal the benefits of using technology in promoting language skills. Minh and Ngan (2019) found that a blended learning program helped improve students' TOEIC listening performance while promoting satisfaction. In addition, this approach has enhanced learners' grammar understanding (Aslani & Tabrizi, 2015; Isti'anah, 2017; Pumjarean et al., 2017). Despite its convenience and self-pace learning benefit, blended learning might not reach its full potential without careful design. Fidjeland (2023) stressed that a flexible learning approach heavily depends on two factors: clear policy structures and incentive systems. A well-structured learning platform might fail to achieve its expected goals if there are no consequences for not participating. In addition to this, Li et al. (2021) also found that the isolation of learning in many web-based courses could hinder language acquisition. This phenomenon is due to the lack of interaction and community support. The latter is paramount of importance in maintaining learning motivation.

Taking this into consideration, this study attempts to offer a blended-learning environment: both face-to-face instruction via Zoom and a web-based application while setting up a Line account to create a learning community. In so doing, participants could improve their skills and limit time and distance constraints. Applying all strengths of each feature concerning its downside, this project aims to promote an effective learning approach that could improve standardized test scores while sustaining students' motivation to learn by themselves.

Ultimately, they could attain their desired scores, which would pave the way for their future career and study.

2. Literature Review

2.1 English Receptive Skills

Listening and reading are receptive skills that act as input, creating an understanding of communication. Mastering these skills is not always effortless, as they are the primary means of communication between native and non-native speakers. There are some challenging elements of the language features which could hinder the learning, such as idioms and connected speech, which can create confusion and misunderstandings for learners trying to interpret spoken or written messages. As a result, comprehending what they hear in real-time could be difficult, especially to those who lack the lexical chunks and grammatical knowledge. Powers (1986) suggested that many studies have been devoted to productive skills, speaking and writing, neglecting receptive skills, listening and reading.

While both skills are considered passive, listening requires a higher level of understanding and integration compared to reading (Reves & Levine, 1988). To explain, second language students might be able to communicate by ignoring unfamiliar vocabulary through listening, whereas in reading, they can derive meaning from contextual cues such as grammatical patterns or connective devices (Buck, 1992). Richards (1983) also underscored the uniqueness of these two skills and suggested that they should be separately taught.

However, despite the revision of the English curriculum in Thailand, the overall proficiency of Thai students is still substandard (Bolton, 2008; Wiriyachitra, 2002). A study conducted by Khamkhien (2010) revealed low proficiency scores in TOEIC and IELTS tests. To resolve this problem, the Ministry of University Affairs suggested that English language teaching in Thai higher education needs to be reformed. One of the solutions is to include taking a standardized English test before their graduation. Although the test has been registered as part of this reform effort, the study found that the English proficiency level of Thai students remained unchanged (Wiriyachitra, 2002).

2.2 Blended-Learning Environment

The first wave of blended-learning definitions is diverse (Sharma, 2010). Sharma provides examples of three combinations: a blend of face-to-face and online teaching, a combination of technologies, and a combination of methodologies. However, the second wave of blended learning is defined by using learning strategies or dimensions (Singh, 2003). In the study, Singh (2003) suggested five different dimensions which are blending offline and online learning; blending self-paced and live, collaborative learning; blending structured and unstructured learning; blending custom content with off-the-shelf content; and blending learning, practice, and performance support. Each design has its own uniqueness and specific purpose for using it. Being defined by various uses of a blended-learning environment, the approach has been utilized much richer and more targeted. In this study, the first definition has been taken: blending offline and online learning, where learning occurs in two platforms: a live class via Zoom and an online web application that provides study materials and resources.

Khan (2009) suggested an e-learning framework, which can be used as a guideline to ensure the effectiveness of online platforms in eight dimensions: institutional, management, technological, pedagogical, ethical, interface design, resource support, and evaluation. Each

dimension consists of sub-dimensions that give a comprehensive checklist to help generate e-learning projects. The scholar also encouraged the developers to ask and raise as many issues as possible to think them through thoroughly. It is worth noting that we do not need to apply every dimension when designing a platform. This variation is because of the different purpose and context of learning.

Table 1
Eight dimensions of the E-Learning Framework

Dimensions of E-Learning	Descriptions
Institutional	The instructional dimension is concerned with issues of administrative affairs, academic affairs and student services related to e-learning.
Management	The management of e-learning refers to the maintenance of a learning environment and distribution of information.
Technological	The technological dimension of e-learning examines issues of technology infrastructure in e-learning environments. This includes infrastructure planning, hardware and software.
Pedagogical	The pedagogical dimension of e-learning refers to teaching and learning. This dimension addresses issues concerning content analysis, audience analysis, goal analysis, medium analysis, design approach, organization, and learning strategies.
Ethical	The ethical considerations of e-learning relate to social and political influence, cultural diversity, bias, geographical diversity, learner diversity, the digital divide, etiquette, and legal issues.
Interface design	The interface design refers to the overall look and feel of e-learning programs. Interface design dimension encompasses page and site design, content design, navigation accessibility and usability testing.
Resource support	The resource support dimension of e-learning examines the online support and resources required to foster meaningful learning.
Evaluation	The evaluation for e-learning included both assessment of learners and evaluation of the instruction and a learning environment.

This study also applied this framework to generate an e-learning platform. For the institutional dimension, the researcher conducted a pre-test to assess the background of students and enquired with the university to provide a website domain. Secondly, the management dimension was designed to aid every participant in ensuring that they were able to join both on the website and in the Zoom meeting. Regarding the technological dimension, the web application had been tested on different devices to ensure that it can be accessed on either iOS or Android systems. Furthermore, pedagogical dimensions: content, goal, and audience were analyzed by using the TOEIC pre-test. Next, ethical consideration: the participants were asked if they could participate in the lesson at the time agreed concerning their work schedule. For interface design, the web application clearly signifies its custom for the participants by using the university display and requires registering by using the university email address. Regarding resources and support, the developer provided materials in both PDF and video formats to aid learning while giving a personal channel to report any problems. Finally, evaluation was the

key to providing immediate feedback to the students. There was a test feature which could check the answer and give the score in real time.

2.2.1 Benefits and challenges in blended-learning environment

It is widely known that blended learning can greatly benefit individual learning, according to several research studies. However, the areas of improvement might be different or contrast with each other. First, a study conducted by Adair-Hauck et al. (2000) found that blended learning benefitted the writing and reading skills of French language learners. However, they did not see the differences in students' speaking and listening skills before and after the intervention. Secondly, Chenoweth and Murday (2003) discovered that their participants had improved their writing skills while the other three skills were indifferent. The scholars commented that the reason why the students' writing improved may be due to the collaboration with peers, as they asked the learners to correspond with each other via emails in addition to discussion board meetings. While only writing seems to have benefited from blended learning according to the two studies, other research by Young (2009) found the difference. Young (2009) explored how a redesigned blended-learning Spanish course could improve students' speaking skills. The result revealed that the experimental group gained higher Stimulated Oral Proficiency Interview (SOPI) scores than the control group.

Moreover, some studies suggest that blended-learning courses assist with listening and grammar studies. Take the study by Minh and Ngan (2019) as an example; they found that TOEIC listening scores improved after the implementation of a blended-learning course, from 40.81 to 54.75 for 16 participants in Vietnam. In addition, three studies conducted in Indonesia and Thailand (Aslani & Tabrizi, 2015; Isti'anah, 2017; Pumjarean et al., 2017) revealed that this method successfully enhanced students' grammar understanding.

Not only does the blended-learning approach have positive outcomes for language learners, but it also has negative sides that challenge educators. Broadbent (2017) conducted a systematic review of self-regulated learning via a blended course. They found that many students did not maintain their regular learning time in the environment of flexibility offered by blended learning, resulting in low improvement.

Furthermore, this notion was applied to Hong et al. (2021) study. This research stressed that the concept of 'anytime, anywhere' could cause procrastination. Therefore, instead of benefiting learners, this platform could hinder the progress of students with low self-regulated learning skills. Self-regulated learning occurs when students need to control their learning by managing their metacognitive and cognitive strategies effectively (Pintrich, 2005). However, achieving self-regulated learning is not easy. Learners need support involving independent functioning that provides students with freedom of choice, resolving issues by themselves (Vansteenkiste et al., 2012). In this study, this point is emphasized by providing all video lessons and an automatic test check system on a web application so that the students can prioritize their own learning and resolve their challenging points by using the test feature. Ultimately, weekly face-to-face lessons on Zoom could serve as their final opportunity to address their issues.

In addition to its full effectiveness as a web-based platform, its accessibility for all students is questionable. While its accessibility is promising, research has recorded inequality that this platform may cause, as some students may not be able to access it or lack technology

literacy, which can hinder their learning experience and exacerbate existing educational disparities.

Regarding the nature of the blended learning approach, it combines two learning modes: synchronous and asynchronous. There are advantages and disadvantages of the two modes. A study by Hung et al. (2024) found that while the effectiveness of the two learning modes yielded similar post-test results in medical students' performance, the synchronous learning mode showed a significantly lower level of cognitive load. This difference might be because of immediate support that the students could receive from the instructors. Furthermore, Patanasorn and Tongpoon-Patanasorn (2024) also revealed a similar result. They found that the quality of translation works done by students was indifferent in synchronous and asynchronous lessons. However, there was a slight preference among learners for synchronous mode, likely due to the immediate feedback and interaction it offers compared to asynchronous learning.

Asynchronous, on the other hand, is considered to widen the educational landscape, in which learning can occur despite distance or time constraints (Riwayatiningsih & Sullistyani, 2020). It is where educators can supply and manage materials e.g., teaching videos, exercises, or slides on the system. This allows students to learn according to their learning pace and time and revisit specific topics which cannot be repeated in traditional classroom settings (Patanasorn & Tongpoon-Patanasorn, 2024). However, Huang and Hsiao (2012) addressed that to achieve effective asynchronous learning, instructors need to prepare meticulously both instructional and exercise materials equipped with prompt guidance and feedback. In so doing, such an approach will motivate learners to learn. Therefore, the essence of creating an online learning paradigm lies in the importance of planning and facilitating.

Hrastinski (2008) suggested balancing the two learning modes. He pointed out that synchronous and asynchronous e-learning complement each other. According to Table 2, the two learning modes offer different functions to serve learning purposes and communication between learners and instructors. While asynchronous e-learning mode allows students to reflect on complex issues and makes it possible to communicate anytime, synchronous mode offers the opportunity for learners to become acquainted with one another and to plan tasks. Regarding the rationale of these practices, asynchronous learning is done to allow more time for everyone to think of their answer, unlike synchronous activities in which an immediate response is required to assess their precision. In addition, synchronous e-learning can greatly motivate the students to commit to their learning by fostering real-time interaction and collaboration, which can enhance engagement and accountability among peers. The asynchronous e-learning mode primarily uses emails, discussion boards, and blogs for communication. Face-to-face meetings complement synchronous e-learning, which frequently uses videoconferencing, instant messaging, and chat. Lastly, the examples of the two modes were given. In an asynchronous e-learning environment, students are required to maintain their learning by writing a blog and sharing their reflections or peer reviews on a discussion board. For synchronous e-learning, students are expected to communicate by using instant messaging; also, teachers may arrange videoconferencing to conduct online lectures.

Table 2

When, Why, and How to Use Asynchronous vs. Synchronous E-Learning

	Asynchronous E-Learning	Synchronous E-Learning
When?	Reflecting on complex issues When synchronous meetings cannot be scheduled because of work, family, and other commitments	Discuss fewer complex issues Getting acquainted with Planning tasks
Why?	Students have more time to reflect because the sender does not expect an immediate answer.	Students become more committed and motivated because a quick response is expected.
How?	Use asynchronous means such as e-mail, discussion boards, and blogs.	Use synchronous means such as videoconferencing, instant messaging and chat, and complement with face-to-face meetings.
Examples	Students expected to reflect individually on course topics may be asked to maintain a blog. Students expected to share reflections regarding course topics and critically assess their peers' ideas may be asked to participate in online discussions on a discussion board.	Students expected to work in groups may be advised to use instant messaging as support to get to know each other, exchanging ideas, and planning tasks. A teacher who wants to present concepts from literature in a simplified way might give an online lecture by videoconferencing.

This research applied this framework by adopting synchronous and asynchronous e-learning activities to create such a rich blended-learning environment. Firstly, a group chat was created using the Line application to allow anytime communication and Zoom videoconferencing every week to motivate students to keep learning. While web applications served as a platform for self-learning, allowing students to practice at their own pace, live lectures via Zoom presented challenges that required students to answer questions immediately when they were posed. This feature allows students to practice their exam skills when time is limited. Also, live sessions provide the opportunity for immediate responses if anyone has a question.

2.2.2 Process of web-based learning applications development

The process of developing a web-based learning application can be varied. Kumar and Goundar (2022) summarized in their systematic literature review article that four main approaches have been used by developers of mobile language learning applications, including some scholars who use a literature review to develop an application. For example, Zhang and Zou (2021) reviewed 41 SSCI-indexed articles and found that multimedia input — particularly audio-animation-caption combinations for vocabulary and grammar, audio-animation for listening, and text-audio for reading — was broadly effective across five tool types, while calling for further research into learner factors and the influence of varied multimedia features

on learning outcomes and processes. Furthermore, Lehman et al. (2020) employed this approach, reading and evaluating existing work in the field to identify areas for improvement, and developed the ELAi app to support spontaneous English speech through adaptive, targeted feedback. Another approach is preliminary studies, in which researchers may first analyze the needs of users and tailor the application accordingly. Take the studies of Chang et al. (2018) and Metafas and Politi (2017) as examples when they employed questionnaires to gather the requirements before developing a mobile application. Motivational factors represent the third approach to creating applications. The researchers, such as Rankin and Edwards (2017) and Khalil et al. (2020), were driven by the existing applications and trying to develop ones for themselves. The last method is technological advancements, which open doors to scholars to initiate new mobile learning applications by providing them with innovative tools and frameworks that enhance the learning experience. Researchers like Park et al. (2011) and Ninan et al. (2019) gathered data on technological advancements and effectively incorporated it into the development of MLL applications.

In summary, four distinct methods, literature review, preliminary studies, motivational factors, and technological advancements, were employed to collect the required specifications. This study applies preliminary and technological advancements. The two methods were used because they specified the needs of the target group in a particular context: the KMUTNB Rayong campus and using technological devices, which students are already familiar with.

After the methods had been selected, the outline of the web application was generated. Table 3 shows the details of the web application description centering around the six issues: requirement analysis, platform, web application type, concept of application, contents, main functions, evaluation, and the target user. For requirement analysis, TOEIC pre-test scores were analyzed to see the needs and the levels of the students. Secondly, a web application was chosen as a platform for self-learning, as it is easy to access and suitable for interactive functions. Next, the type of web application includes interactive teaching videos and exercises based on lecturing and practicing concepts. In each unit, five main learning activities are included: grammar, listening, reading, vocabulary, and a crossword. Each activity consists of teaching videos and exercises. Materials accompanying the videos can be downloaded as a PDF file. The main functions for each unit are browsing teaching videos, doing multiple-choice exercises and tests, studying vocabulary, and playing crossword puzzles. When the first phase was completed, the students were asked to complete satisfaction surveys.

Table 3

Web Application Development Framework

Issue	Description
Requirement analysis	TOEIC pre-test
Platform	Web application
Web application type	Interactive including videos and exercises
Concept of application	Lecturing and practicing
Contents	Reading and listening exercises, grammar and vocabulary exercises

Main functions	Provide content knowledge and exercises for students who are preparing themselves for standardized English tests e.g. TOEIC, K-STEP.
Evaluation	SUS instrument, feedback from users
Target user	Undergraduates from KMUTNB Rayong campus

This study aims to explore the benefits of a blended-learning environment that improves students' receptive skills and maintains their learning motivation, particularly considering the previously mentioned low proficiency and the need to promote self-regulated learning.

The research questions are 1) To what extent could web applications via blended learning improve KMUTNB undergraduates' listening and reading skills for the TOEIC test?, and 2) How do undergraduate students perceive the effectiveness and usability of web-based blended learning approaches for developing English receptive skills?

3. Methodology

3.1 Research Process

The focus of this study is to explore the effectiveness of a web application in a blended-learning environment to improve students' receptive skills. The process is divided into three stages: need analysis, blended-learning instruction using a web application and live classes on Zoom, and web application prototyping.

The participants were 3rd and 4th-year students from the Faculty of Business Administration, the Faculty of Engineering and Technology, and the Faculty of Science, Energy and Environment. Then, a TOEIC pre-test was conducted to see the needs. Thereafter, an online lesson on Zoom started while the web application was initially developed. Two months later, after the pre-test, the participants were invited to use the web application. Later, the Likert-4-scale questionnaire was distributed to the participants for feedback and was analyzed by using descriptive statistics. Once the feedback was collected, the second phase of development was processed according to the participants' needs. Finally, the TOEIC post-test was conducted to see the improvement of the language skills, while a questionnaire was distributed to gather feedback on the web application prototype. Also, attendance records on live Zoom lessons and logging on to tests featured on the web application were observed and analyzed to triangulate data. Finally, a semi-structured interview was arranged with seven volunteering students to gain some insight into the blended-learning experience.

3.2 Research instruments

There are four research tools implemented in this study: TOEIC pre- and post-tests, questionnaires, participation recordings on Zoom and web application, and an interview.

1. TOEIC pre- and post-tests
2. Questionnaires
3. Attendance on Zoom and test feature use on web application recordings
4. Interview

Firstly, the TOEIC pre- and post-tests were used to evaluate participants' background and measure the improvement after the intervention. Secondly, the System Usability Scale (SUS) survey was conducted to gain feedback from the participants during the first phase of the web application development and a second time after the prototyping to measure the

satisfaction rate. The questionnaire showed strong reliability, with a Cronbach's alpha of 0.83. Next, attendances on both platforms were recorded to analyze the engagement statistics. These results will provide our understanding of contextual information about the learning environment. Lastly, semi-structured interviews were arranged with students to get valuable feedback about their experiences, both positive and negative, in a blended-learning environment. An expert checked the validity of the questions to ensure they would cover the purpose of the study. This study aims to provide a holistic view of the web application in a blended-learning environment by utilizing test scores, surveys, and interviews as research tools, incorporating both quantitative and qualitative data.

3.3 Research participants

There were 100 participants enrolled in the program. They were third- and fourth-year students. However, the number of participants dropped out to 35 by the end of this study, resulting in 35 questionnaires answered. The decrease in participants stemmed from the graduation of year 4 students, schedule conflicts among internship program-joining students, and the university's semester break. A priori power analysis was conducted using G*Power version 3.1.9.7 statistical software (Faul et al., 2007) to determine the minimum sample size required for adequate statistical power. For the paired samples t-test comparing pre- and post-intervention measurements, the analysis was configured with an alpha level of .05, a desired power of .80, and a medium effect size (Cohen's d = 0.5). The power analysis indicated that a minimum sample size of 27 participants would be required to detect statistically significant differences between pre- and post-test measures with 80% power at the .05 significance level. The announcement was made through each department to recruit the participants from the three faculties on the KMUTNB Rayong campus: Business Administration, Science and Engineering. The participants could register by themselves via a Google form, which was introduced through their departments. The participants were then registered on a web-based application and invited to join a live class on Zoom every Wednesday 7-8 p.m. The online feedback of the web-based system and opinions about the blended-learning environment were gathered from all participants. However, the seven participants who were highly active on both platforms were selected to participate in an interview to triangulate the results.

3.4 Data Analysis

There were three stages of data analysis. First of all, the need analysis was done by using the TOEIC pre-test. Then, the development of a web-application in a blended-learning environment was designed and conducted. The questionnaire and interview were launched to gather feedback to improve the learning method and contents.

Table 4
Data Analysis

Research phases	Research question	Research instruments	Analysis methods
Pre-test **Web application Development**	1) To what extent could web applications via blended learning improve KMUTNB undergraduates' listening and reading skills for the TOEIC test?	TOEIC Pre-test SUS Questionnaire	Paired sample t-tests Descriptive statistics
	2) How do undergraduate students perceive the effectiveness and usability of web-based blended learning approaches for developing English receptive skills?	Interview	Content analysis
Effectiveness of learning method and contents	1) To what extent could web applications via blended learning improve KMUTNB undergraduates' listening and reading skills for the TOEIC test?	TOEIC Post-test	Descriptive statistics
	2) How do undergraduate students perceive the effectiveness and usability of web-based blended learning approaches for developing English receptive skills?	Questionnaire Attendance records	Descriptive statistics
		Interview	Content analysis

4. Results/Findings

Research question 1: To what extent could web applications via blended learning improve KMUTNB undergraduates' listening and reading skills for the TOEIC test?

To answer this question, a paired-samples t-test was conducted to see the improvements of the blended-learning package. The number of students who provided pre- and post-test scores is 27. This number is acceptable according to the G*Power calculation.

Table 5
Paired Samples t-test of TOEIC Listening and Reading Tests

Pair		Mean	N	Std.Deviation	Std.Error Mean
Pair 1	Listening 1	31.7037	27	10.71238	2.06160
	Listening 2	44.7037	27	11.01333	2.11952
Pair 2	Reading 1	35.5556	27	14.16207	2.72549
	Reading 2	42.6667	27	14.34198	2.76011

The paired samples t-test of listening scores showed an increase of 13.00 points, from a pre-test mean of 31.70 (SD = 10.71) to a post-test mean of 44.70 (SD = 11.01). Reading skills also showed improvements after the course. The increased mean score of 7.11 points suggests progress in their learning. The higher paired sample t-test of 4.74 and 9.49 points indicates the improvement of participants, with statistical significance, $t(26) = -16.6$, $p < .001$. Furthermore, the magnitude of the intervention effect was enormous (Cohen's d = 3.19), indicating a substantial impact of the web-based learning system on students' listening and reading performance. However, it is worth noting that due to the sharp reduction of the number of participants (from 100 to 27) between pre- and post-tests, this result might be the effect of bias.

Research question 2: How do undergraduate students perceive the effectiveness and usability of web-based blended learning approaches for developing English receptive skills?

This section discusses findings of students' perceptions towards the effectiveness of a web-based application via a blended-learning approach. A survey and an interview were applied to gain both quantitative and qualitative data. The web application questionnaire was conducted two times (n = 100 in Phase 1, and n = 35 in Phase 2). To gain meaningful insights, an interview with 7 students was arranged. The findings are presented thematically, starting by overall satisfaction, followed by effectiveness of each function on the web application, engagement patterns, and perceptions of the blended-learning approach.

Overall, students were satisfied with the web application, as shown in the high mean scores of 3.39 (84.75%) to 3.68 (88.5%) on the 4-point Likert scale. The listening practice feature is scored slightly higher in Phase 2 than in Phase 1 at 3.51 (87.75%) and 3.39 (84.75%), respectively. Learning features on the web application were consistently highly rated in both phases. Not only was vocabulary learning function increasingly rated in satisfaction from 3.52 (88%) to 3.57 (89.25%) in phases 1 and 2, but grammar learning function was also higher rated from 3.48 (87%) to 3.54 (88.5%). Moreover, reading a learning feature was most highly satisfying, shown in the higher mean score of 3.41 (85.25%) in Phase 1 and 3.57 (89.25%) in Phase 2.

Thirdly, usability regarding the ease of use remained relatively unchanged from 3.39 (84.75%) to 3.40 (85%). Regarding content presentation, the mean was slightly higher from 3.32 (83%) to 3.40 (85%), suggesting the improvement of content clarity. The most favorable function that gained the highest satisfaction seems to be the test features, which increased from 3.36 (84%) to 3.60 (90%) in the second phase.

A similar vein also applies to content appropriateness, which received higher satisfaction scores from 3.44 (86%) to 3.54 (88.5%). Next, the lengths of teaching videos were considered proper. The satisfaction rates rose from 3.33 (83.25%) to 3.57 (89.25%), representing a 6% increase.

While most features got a higher satisfaction rate in Phase 2, technical issues significantly increased from 2.93 (73.25%) to 3.17 (79.25%) in Phase 2. In addition to technical problems, sound quality for listening tests was addressed to be worse in the second phase, from 3.23 (80.75%) to 3.14 (78.5%). However, listening to exercise audio was equally qualified at 3.25 (81.25%).

There were several new features invented in Phase 2: a log-in system, feedback, and a crossword game. The satisfaction rates of these three new features were relatively high at 3.45

(86.25%), 3.68 (92%), and 3.57 (84.25%), respectively. The register function was completed during phase two with a 3.45 (86.25%) satisfaction score. Moreover, the immediate feedback after the completion of each exercise received the highest satisfaction at 3.68 (92%), indicating that they found feedback useful. Lastly, the crossword game was the latest feature of the web application. It received a high satisfaction rate of 3.57 (84.25%) out of 4.

Table 6

Web Application Satisfaction Survey Results

Topics	Average score		Meaning
	Phase 1	Phase 2	
1. How satisfied are you with the web application?	3.39 (84.75%)	3.54 (88.5%)	High
2. How satisfied are you with the vocabulary learning feature on the web application?	3.52 (88%)	3.57 (89.25%)	High
3. How satisfied are you with the grammar learning feature on the web application?	3.48 (87%)	3.54 (88.5%)	High
4. How satisfied are you with the reading learning feature on the web application?	3.41 (85.25%)	3.57 (89.25%)	High
5. How satisfied are you with the listening learning feature on the web application?	3.39 (84.75%)	3.51 (87.75%)	High
6. How satisfied are you with the test feature on the web application?	3.36 (84%)	3.6 (90%)	High
7. How easy is the web application to use?	3.39 (84.75%)	3.4 (85%)	High
8. How easy is it to understand the content of each unit in this web application?	3.32 (83%)	3.4 (85%)	High
9. How much do you think each unit in the web application provides appropriate content?	3.44 (86%)	3.54 (88.5%)	High
10. How much do you think each unit in the web application provides appropriate exercises?	3.46 (86.5%)	3.54 (88.5%)	High
11. How much do you think the length of videos in each unit on the web application is appropriate?	3.33 (83.25%)	3.57 (89.25%)	High
12. How satisfied are you with the sound quality of listening exercises in each unit on the web application?	3.25 (81.25%)	3.25 (81.25%)	High
13. How satisfied are you with the sound quality of listening tests on the web application?	3.23 (80.75%)	3.14 (78.5%)	High
14. How often do you experience technical problems while using this web application (e.g., login, streaming, etc.)?	2.93 (73.25%)	3.17 (79.25%)	Medium/ High
15. How satisfied are you with the login system of the web application?	N/A	3.45 (86.25%)	High

*16. How satisfied are you with the feedback system for each exercise on the web application?	N/A	3.68 (92%)	High
*17. How satisfied are you with the crossword feature on the web application?	N/A	3.37 (84.25%)	High

*Questions asked in Phase 2 only

While the web application satisfaction survey revealed a high level of satisfaction, the attendance record of tests done on the web application was not as high as the number of registered participants. It is worth noting that these are the partial statistics collected from the system. This number does not include other times that students interacted with other activities e.g., browsing teaching videos, downloading materials, or playing crosswords, as the development has not been fully developed yet. Table 7 illustrates the count of each test participation and the average time they spent on doing the tests.

Table 7

Web Application Tests Function Usage Record

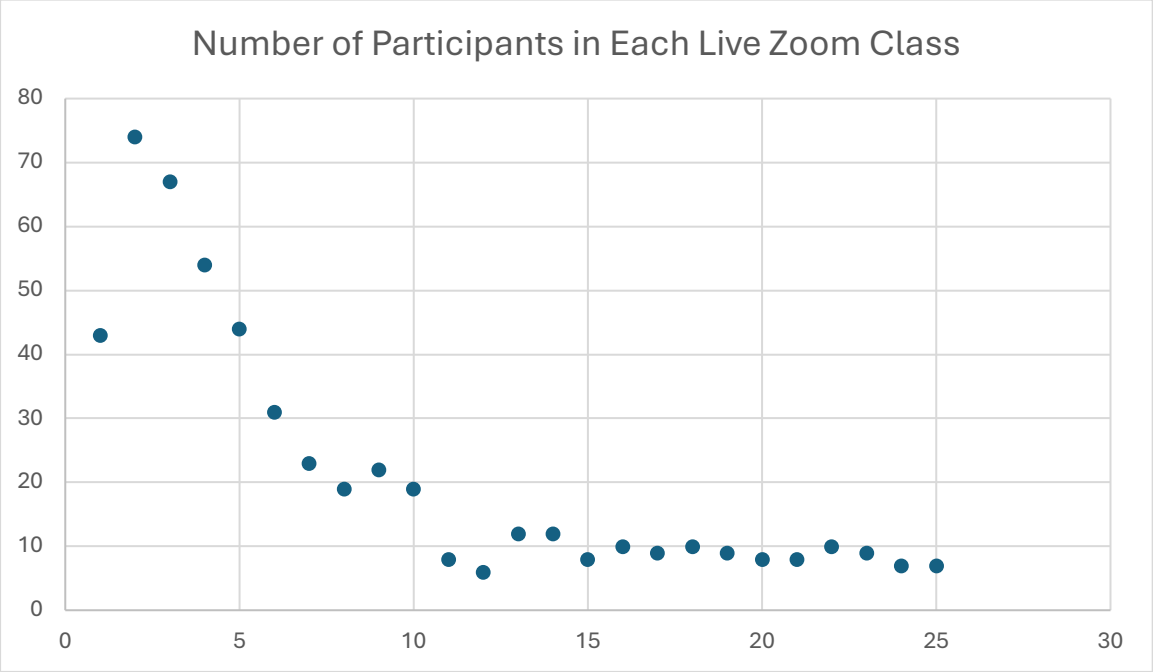
Test part	No. of completions
Grammar	42
Listening	38
Vocabulary	21
Reading	21
Average of time spent on each test: 3.58 minutes	

The usage data from the web application reveals similarly concerning engagement patterns across all skill-based testing components (see table 7). Grammar tests achieved the highest completion rate with 42 completions, followed by listening tests with 35 completions. Vocabulary and reading tests seemed to receive the lowest visiting times compared to other features, with only 21 completions from all participants. These statistics indicate a significant underutilization of the platform, given the total number of participants. Moreover, the average time spent (3.58 minutes) on each test feature raises an issue of students' engagement. This suggests that many students might shortly interact with the content rather than investing the focused attention necessary for meaningful skill development. The low rate of completion across these skill test functions indicates that the challenges of learning are not about the content but rather are more about self-regulation or motivational factors.

In addition to records of web-application attendance, the number of participants in Zoom live sessions was collected every week. The 8-month study allowed participants to study online via Zoom 25 times. Figure 1 represents the number of participants in each class.

Figure 1

Number of Participants in Each Live Zoom Class in 25 Lessons



Follow-up interviews were conducted to explore this scenario in greater depth. Seven highly motivated students were interviewed regarding their satisfaction with the web-application-based blended learning environment and their learning motivation. The interview protocol consisted of six questions. Table 8 illustrates the number of students responding to each theme and provides sample responses. Themes emerged following analysis of transcribed interview data.

The first question: What do you think about blended learning for this course? explained students' overall perceptions of the blended learning approach. Convenience was most frequently mentioned by all students, followed by their ability to distinguish between the functions of the two platforms: the web application and live learning sessions via Zoom. Students described how they utilized each platform differently. Usefulness and learning motivation were mentioned less frequently, by three and two students, respectively.

When asked, "Do you think that the content on the web application and Zoom is related? Why or why not?" all participants confirmed that content from both platforms was related. They agreed that the web application content was more detailed and needed to be studied prior to live Zoom sessions or could be revisited if they did not clearly understand the live instructions.

Question three: What are the advantages of blended learning for this course? Regarding the advantages of blended learning for this course, convenience emerged as the primary benefit. All participants reported that they could study anytime and anywhere. They also appreciated being able to ask questions during live sessions when needed. Additional benefits included self-assessment opportunities, as the web application provided immediate feedback after completing tests, and access to various practice tests.

Question four, on the other hand, asks to discover limitations of blended-learning courses: What are the disadvantages of blended learning for this course? When asked about limitations of the blended learning course, several themes emerged. The most prominent

concern was the need for more hours of live instruction. Most students (five out of seven) expressed a desire for longer sessions with the instructor, either through extended class time or additional weekly sessions. Second, students identified the need for more detailed explanations within the web application platform. Students sometimes required comprehensive answers that were not available during independent web-based study. Additionally, live sessions could become uncomfortable when students felt reluctant to ask questions in front of many classmates. Students also noted that appropriate background knowledge and high self-motivation were prerequisites for success in blended learning. There was one participant stating that he or she had difficulty in connecting content from the web application to online Zoom lessons. However, others highlighted that self-discipline is paramount of importance.

Question five: What advice would you give to non-English major students to learn English? 3) The purpose of this question is to seek better understanding of how to support English learning for learners who might not be keen on language learning. Two participants mentioned the need for scaffolding courses (e.g., vocabulary or listening skills) to improve students' foundational knowledge before enrolling in this course. Additionally, suggestions included offering on-site classes and creating supportive learning environments. Clear goals and self-discipline were also emphasized as paramount for success.

Question six: What are your motivations for studying this course? This question examined whether motivation influenced self-regulated learning behavior. Most students (four out of seven) indicated that they needed TOEIC scores for job applications, while some engineering students mentioned that they needed to improve their skills themselves, realizing that they needed quite a long time to excel.

Table 8

Number of Students and Sample Accounts of Semi-Structured Interview

Questions	Number of students	Themes	Examples
1. What do you think about blended learning for this course?	6	Different functions	Web-application offers detailed explanation while studying live sessions on Zoom expand the knowledge.
	7	Convenience	I can go back and review on Web-application anytime.
	3	Usefulness	I learned a lot from the two platforms.
	2	Motivation	It motivated to learn more. I started to feel good about studying English.

2. Do you think that the content on the web application and Zoom are related? Why or why not?	7	Related	The content on the web application are divided into parts, while the main activity on Zoom is to apply those ideas to the mock tests. The content on the web application is more in detail. They are related because some weeks, I have to review the material on the web application before joining the live lesson.
3. What are the advantages of blended learning for this course?	7	Convenience	It's very convenient, I could study at times when the university is close. I can review as much as I want. When I have questions during self-study on the web application, I can ask the instructor later in Zoom.
	1	Self assessment	I can assess my skills every week as the live class offers tests to practise with the instructor.
	1	Various tests exploration	I experience many past test papers from this blended learning course.
4. What are the disadvantages of blended learning for this course?	5	More hours needed	I wish we could learn more than an hour on Zoom.
	2	Prompt explanation needed	I couldn't ask questions when I learned on web application. I was afraid to ask questions when there were many students studied together on Zoom.

	2	Gaps in background knowledge and new content	Sometimes I couldn't make link between what I learned on web application and live class on Zoom. It may be because of my little background of English.
	3	Motivation and discipline	It requires high self-discipline and motivation.
5. What advice would you give to non-English major students to learn English?	1	Learning modes	We should have onsite classes so that we would have supportive learning environment.
	2	Scaffolding course	There should be vocabulary and listening preparation courses prior to this one. As students have different backgrounds of knowledge, there should be pre-sessional courses to scaffold them.
	1	University driven	I suggest having more selective English subjects in the curriculum.
	1	Goal setting	The students should have a clear aim and purpose of learning. They should know the benefits of TOEIC test.
	3	Clear goal	Firstly, I didn't like learning English so much. But later I realized that I need TOEIC for my job application and for Work and Travel program. I realized its importance when I joined the internship program. I also need TOEIC score for my job application.

			I certainly need the score for my job application.
6. What are your motivations for studying this course?	3	Intrinsic motivation	I feel that I'm not good at languages, so I need to learn. I know that engineering student like me needs some time to master the language skills. I wanted to improve myself. I don't think I'm good at English.

5. Discussion

5.1. Web-Based Blended Learning Effectiveness

This study demonstrated significant improvements in TOEIC receptive skills through blended learning, with listening skills showing 13-point gains and reading skills improving by 7 points over eight months. However, the sharp drop in participants from 100 to 27 between pre- and post-tests may have biased this result. Nonetheless, its effectiveness was highly compromised by low and inconsistent engagement, which suggests that many students did not actively participate in the learning activities or utilize the resources provided. There is also a question raised about the relationship between the high rate of web-app satisfaction and the actual participation of Zoom sessions and web-app usage. From this scenario, it can be argued that students were lacking self-regulated learning. This phenomenon occurred in Garrison et al. (2010) study, where the researcher found that autonomous learning requires more structured support despite the fully equipped technology. Furthermore, Li et al. (2021) supported the claim that students who are struggling with self-direction learning could not fully achieve the fullness of the program's potential. These results indicate the downside in present blended learning implementations: assuming students possess adequate self-regulation skills without providing appropriate scaffolding or motivation systems. As a result, there should be a learning community where students could be supported and motivated to learn. Those factors might include incentives such as financial rewards, recognition programs, and policy changes from the university that promote engagement and attendance in blended learning environments.

5.2. Incentives and Policy Considerations

As the low attendance, both in Zoom sessions and on the web application, was clearly noticeable in this study, there is a need to call for clear policies or incentives from the university to help streamline future blended courses. There might be payment required if the students cannot commit to the course. In so doing, the withdrawal rate might be decreasing, as suggested by Lee and Yeung (2022) that self-paid students were unlikely to drop out of the course. Furthermore, a university might endorse the program by awarding some scholarships to those who attentively participate in the course. Scholarships, however, should not be too simple to receive. On the other hand, it should be clearly defined by expectations, grading, and application process (Fidjeland, 2023), as students would independently focus more on trying to master the skills rather than desiring to receive the money.

Another solution would be a refund. Completely complimentary courses should not be provided without the regulations or clear rules of how to participate in the course. Students should pay for the course fee at the start and get a refund if they commit themselves to 80% of the course time. In addition to the course fee, the university should also consider factors that could improve students' intrinsic and extrinsic motivations. Setting up learning communities would be worth trying. Anderson (2003) and Garrison et al. (2010) have seen the importance of learning community and orientation, as they could bridge the gap between student autonomy and necessary guidance. Lastly, Chanthap and Wasanasomsithi (2019) highlighted that self-regulated learning skills play an important role in creating intrinsic motivation. Hence, activities such as goal setting, planning, organizing, memorizing, and self-monitoring should be clearly instructed.

5.3. Framework for Blended-Learning Platform Implementation

There should be three phases of a blended-learning course. Before adopting a self-learning platform into an educational institution, educators should address a comprehensive framework covering three implementation phases: pre, during, and post. First, before starting the course, there should be a checklist of students' readiness in terms of learning equipment and self-learning strategies. An orientation session would be useful to introduce the course and give clear goals for the course. During the implementation, the course should provide systematic attendance check, encourage group learning, and give feedback to sustain students' engagement. Lastly, a post-program assessment should be conducted to evaluate the course's efficiency and address the issues emerging from the course.

6. Limitations and Future Research

There are several limitations of this study. Firstly, the number of participants for Phase 2 was small (n = 27) compared to Phase 1 (n = 100). This is the most problematic area, which might lead to potential biases in this study. Therefore, the results cannot be generalized. Furthermore, there is no guarantee of the sustainability of the skills improvement from a relatively short 8-month course. For future research recommendations, it would be useful for further investigation of online learning withdrawal to find solutions to solve those gaps. Ultimately, changing focus from assessing learning outcomes to exploring ways in which students are sustainably motivated to control their learning would be greatly beneficial to the field.

7. Conclusion

There is a significant contradiction between the study's findings. While the web application and language content received high satisfaction, the participation rates dramatically dropped over the 8-month period. This contradiction raises the question of the effectiveness of free, flexible educational programs where disengagement was found. From a pedagogical standpoint, the findings highlight that blended learning environments cannot assume students arrive with adequate self-regulated learning skills. Instead, institutions must actively scaffold learner autonomy through structured activities such as goal setting, self-monitoring, and peer learning communities. Orientation sessions, systematic attendance tracking, and consistent feedback mechanisms should be embedded throughout course delivery rather than treated as supplementary features. From a design perspective, future web-based learning platforms

should integrate engagement-sustaining elements such as progress tracking, community interaction features, and gamified incentives that reinforce consistent participation. Institutionally, universities should reconsider the fully complimentary course model by introducing policy-driven incentives such as fee refund schemes, scholarship opportunities, or formal course credit recognition to reinforce commitment and reduce withdrawal rates.

8. About the Author

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10. Declaration of AI Use

The author declares that this manuscript was prepared entirely without the use of generative AI technologies.

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