



A Study on the Use of AI-based Learning Programs by EFL Students with Different Types of Teacher Support

Hea-Suk Kim (Seoul Women's University) Na-Young Kim (Sehan University)
Yoonjung Cha (Hanshin University)



This is an open-access article distributed under the terms of the Creative Commons License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium provided the original work is properly cited.

Received: March 12, 2022
Revised: April 15, 2022
Accepted: April 27, 2022

Heasuk Kim (1st author)
Professor, Institute for General Education, Seoul Women's Univ.
Email: shskim@swu.ac.kr

Na-Young Kim (corresponding author)
Professor, Dept. of General Education, Sehan Univ.
Email: nykim@sehan.ac.kr

Yoonjung Cha (corresponding author)
Professor, Peace and Liberal Arts College, Hanshin Univ.
Email: yjcha@hs.ac.kr

ABSTRACT

Kim, Hea-Suk, Na-Young Kim and Yoonjung Cha. 2022. A study on the use of AI-based learning programs by EFL students with different types of teacher support. *Korean Journal of English Language and Linguistics* 22, 355-376.

The purpose of this study was to investigate the impact of teacher support and its role on students' self-regulated learning in an online English learning environment. One hundred and twenty-one participants registered for online TOEIC classes during the fall semester of 2021. Students in the classes were required to use the AI-based TOEIC program for the whole semester. They were randomly divided into three different teacher support groups: cognitive, emotional, and autonomy. To examine how each type of teacher support can be effective for online TOEIC classes, participants took pre- and post-tests that consisted of vocabulary and grammar. Also, students conducted two questionnaires including self-regulated learning and their perceptions toward using the online program. Regarding the pre- and post-tests, the findings indicated that significant differences were found in all teacher support groups for vocabulary, but mixed results were found in terms of grammar. In fact, there was no significant difference among the three teacher support groups. In terms of self-regulated learning, there were significant differences between the pre- and post-questionnaires for both the cognitive and autonomy groups, but not for the emotional support group. Furthermore, no significant differences were discovered based on the different types of teacher support provided. However, when it came to students' perceptions of an AI-based online English learning program, there were significant differences in all items across the three teacher support groups. The findings are used to suggest pedagogical implications and future research.

KEYWORDS

teacher support, cognitive, emotional, autonomy, AI-based TOEIC program, online learning, perception, grammar, vocabulary

1. Introduction

To promote students' English skills, various forms of technology have been used in language learning settings. Recently, artificial intelligence (AI) technology has gained much attention in language classrooms and proved to help increase the students' English language skills (Kim, Cha and Kim, 2020). With the advancement of AI technology, language professionals have continuously examined whether these advancements have indeed translated into more effective language learning. Kim, Kim and Cha (2021), for example, confirmed the positive effects of AI technology on English language proficiency. Yang and Kim (2021) also revealed that students had positive perceptions toward AI technology for their English learning.

AI technology has particularly played a crucial role in increasing students' scores on official English tests including the Test of English for International Communication (TOEIC). Jones, Richards, Cho and Lee (2018) discovered that many students use AI technology to prepare themselves for the TOEIC. According to them, as AI-based applications have widely been used in and out of language classrooms, many students have been depending on AI technology for effective test preparation. Furthermore, AI-based TOEIC preparation applications have been developed. For example, *Santa TOEIC* has received much attention, playing the role of an AI tutor with the goal of increasing student test scores (Kim et al. 2020, Loh et al. 2021).

AI has been beneficially used by students of English, especially in Korea where the TOEIC is an important test when hiring and evaluating future employees' English skills (Kim 2009). Given that many students rely on AI technology for their learning, Jones et al. (2018) noted that students might not feel the need for teachers and/or classroom learning. Accordingly, teachers might think that they are at risk of being replaced by AI and of eventually losing their jobs. Selwyn (2018) also noted that soon we will likely see teachers under pressure to justify their profession. As advances in AI technology are prompting calls for teaching to be automated and learner-driven, the role of human teachers is under threat.

However, teachers still play an important role in enhancing student motivation and confidence while monitoring and guiding their learning. More importantly, human teachers can teach authentic English, which AI cannot do. According to Jones et al. (2018), the background of the language, cultural nuances, and correct context are important aspects of actual language that students cannot learn from AI technology. Such aspects can be more effectively taught by a human teacher rather than an AI tutor. In this regard, human teachers cannot be fully replaced by AI tutors (Selwyn 2018).

According to Song (2017), AI applications should be designed for specific roles and should be developed to fulfill their users' needs. Park and Shin (2017) also claimed that AI technology should be applied to a more specific learning application by meeting the needs of students, and more importantly, its role should be divided between AI tutors and human teachers. In light of this, helping teachers to successfully integrate AI-based applications into their classrooms should be an important consideration. To do so, appropriate teacher guidance and management of those applications are very much needed (Jones et al. 2018). It is also important that students have proper teacher support.

According to Luan et al. (2020), teacher support is an important factor that can affect students' language proficiency. Previous researchers have reported that teacher support plays a vital role in improving students' motivation, learning engagement, and linguistic achievement (Kazemi, Zarehmoghadam and Emami, 2016, Kiefer, Alley and Ellerbrock 2015). By providing students with help for their learning tasks while representing the concerns and interests of the students, teachers support their students' learning (Mitchell and DellaMattera 2011). Such support is an embodiment of teachers' behaviors and an indispensable variable for understanding students'

academic achievement (Piechurska-Kuciel 2011). In short, teacher support is vital to students' academic development, learning outcomes, and affective or emotional outcomes (Lei, Cui and Chiu 2018).

Given that teacher support positively influences students' language proficiency (Luan et al. 2020), the role of human teachers also seems pivotal in English learning environments. Nonetheless, there has been a dearth of empirical research on this issue. Not many studies have examined the effects of teacher support on English learning (Yang and Kim 2021). In this regard, the current study aims to explore the effectiveness of teacher support in English learning environments. To be more specific, given that teacher support can be viewed in a multidimensional way (Chai and Gong 2013, Liu, Zhang and Liu 2017), this study breaks down teacher support into three distinct categories: cognitive support, emotional support, and autonomy support. Especially in English learning settings, Yang and Kim (2021) suggested that the effectiveness of teacher support should be investigated from these three dimensions.

Furthermore, previous studies have focused on the effects of AI-based applications on TOEIC score improvement (Kusumaningrum and Pertivi 2021, Obari and Lambacher 2019, Obari 2020, Obari, Lambacher and Kikuchi 2020). In this regard, it is also necessary to explore the effects of AI applications on other aspects of language skills such as grammar and vocabulary. The present study, therefore, investigates the effectiveness of teacher support in AI-based English learning environments focusing on students' grammar and vocabulary learning. Moreover, the current study explores the relationship between teacher support and self-regulated learning using AI technology. According to Persico and Steffens (2017), advances in technology have improved technology-based learning environments that support self-regulated learning and there is a positive relationship between self-regulated learning and academic achievement. Turan and Demirel (2010) insisted that if students' self-regulated learning skills are developed, their academic understanding and learning efficiency will improve. Taking all this into consideration, the research questions for the study were as follows:

- a. Is there a significant difference in students' grammar and vocabulary improvement when learning with an AI-based TOEIC program according to the three different types of teacher support?
- b. Is there a significant difference in students' self-regulated learning (SRL) after participating in an AI-based TOEIC program according to the three different types of teacher support?
- c. What are students' perceptions toward using an AI-based TOEIC program?

2. Literature Review

2.1 Teacher Support

Teacher support indicates the support students get from their teachers. It has been viewed within the concept of social support. According to Caplan (1974), social support refers to the support an individual receives from their family members, friends, neighbors, teachers, and so on. In this regard, Malecki and Demaray (2002) divided social support into parent support, peer support, and teacher support. For children, family support is important for their learning achievement. As they spend much time with their peers and teachers in school, students become less influenced by their families but more influenced by the school environment (Kiefer et al. 2015). Peer support and teacher support become stronger and more obvious, having direct relations with students' learning (Yang and Kim 2021).

According to Lei et al. (2018), teacher support is vital to students' academic development, not only including learning outcomes but also including affective or emotional outcomes. It occurs when students receive cognitive support (Skinner, Furrer, Marchand and Kindermann 2008), emotional support (Skinner and Belmont 1993), or autonomy support from their teacher during the learning process (Wellborn and Connell 1987). Chai and Gong (2013) insisted that teacher support also occurs in these three different ways including cognitive support, emotional support, and autonomy support. Other language scholars have also viewed teacher support in the context of these three types of support and confirmed their positive effects on students' learning (Liu et al. 2017).

Cognitive support includes providing students with academic challenges (Lam and Law 2007) and cognitive differences (Richland et al. 2016). It also stimulates the students' learning curiosity (Lam and Law 2007) and promotes the students' understanding of concepts (Chai and Gong 2013). Emotional support refers to the teachers' emotional connection to their students (Titsworth, Quinlan and Mazer 2010). It includes their positive attention and care as well as support for the students especially when they are under pressure. As for autonomy support, teachers give their students freedom and support in their learning from arranging academic tasks to choosing learning content and methods. It includes the teachers' low control and high respect for students' views and feelings, providing sufficient opportunities for students' academic activities (Skinner and Belmont 1993). This type of support aims to enhance students' learning autonomy (Yang and Kim 2021).

Students' language proficiency can be influenced by many factors such as motivation, anxiety, self-efficacy, and learning engagement (Yang and Kim 2021). According to Luan et al. (2020), teacher support is also an important factor that can affect language proficiency. Previous scholars have confirmed the positive effects of teacher support on linguistic achievement. They have divided teacher support into three types of support – cognitive support, emotional support, and autonomy support – and investigated their effects on students' linguistic achievement. Kazemi et al. (2017), for example, conducted an empirical study and found that cognitive support has a crucial role in improving students' language performance. Wentzel, Battle, Russell and Looney (2010) also proved that language students can benefit from their teacher's emotional support. Dincer, Yesilyurt and Takkac (2012) also confirmed that students can promote their learning outcomes if their teacher provides autonomy support.

Yang and Kim (2021) found that autonomy support was more effective than emotional support for students of English in China. In their study, the autonomy support group that had options to choose from in regards to curriculum management, task design, and learning materials significantly improved their English listening ability compared to the emotional support group. These findings were in accordance with previous research (Liu et al. 2017) suggesting that language students benefited more from autonomy support than from emotional support. Dincer et al. (2012) also reported that students who receive more autonomy support had a higher level of language proficiency, showing better performance in learning.

However, previous studies have shown mixed findings regarding the effects of emotional support and cognitive support. While some scholars have discovered the superior effects of emotional support compared to cognitive support, others have shown the opposite. Liu et al. (2017), for example, found that emotional support was more effective than cognitive support in students' learning. In contrast, Yang and Kim (2021) reported that students benefited more from cognitive support than emotional support regarding language proficiency. Rajuan, Beijaard and Verloop (2008), however, confirmed that emotional support was as effective as cognitive support. Regarding the differences in the effects of cognitive support and autonomy support, Yang and Kim (2021) discovered that there were no differences between the effects of cognitive and autonomy support regarding language proficiency improvement.

Previous scholars in language learning settings have emphasized the importance of teacher support and reported that all three types of teacher support – cognitive support, emotional support, and autonomy support – can positively influence students' learning (Liu et al. 2017, Yang and Kim 2021). However, only a few have studied the effects of teacher support on English learning (Luan et al. 2020). Furthermore, there have been mixed results when determining which type of teacher support is more effective than the others. In this regard, it is essential to examine whether the effects of teacher support on English learning differ depending on the types of teacher support.

2.2 Artificial Intelligence (AI) and TOEIC

The Test of English for International Communication (TOEIC) was developed by the Educational Testing Service (ETS), one of the world's largest nonprofit assessment organizations. As an international standardized test for non-native speakers of the English language, the TOEIC measures a test taker's everyday English skills required to work in an international environment. According to previous scholars (Gilfert 1996, Kim 2020), the test has been the most adopted English-language test around the world. It has not only been largely used in South America and Europe but is also widely used all over Asia, including South Korea.

In South Korea, English is the most important foreign language. According to Kim (2009), the TOEIC is the high-stakes official test and has a crucial effect on Korean students' future careers. Most job seekers in Korea are required to submit their test scores to prove that they have adequate English proficiency. For this reason, the majority of Korean universities have encouraged students to improve their English proficiency for job searches (Kim 2019). This has made students struggle to make themselves more proficient for competitive job markets by increasing their English skills (Kim 2020).

To promote Korean students' English skills, different forms of technology have been employed in language classrooms. Among them, AI technology has played a particularly crucial role in increasing students' TOEIC scores. AI has been beneficially used by students of English in South Korea where the TOEIC is an important test when hiring and evaluating future employees' English skills (Kim 2009). Previous scholars have found that many Korean students use AI technology to prepare for the TOEIC. According to Jones et al. (2018), AI-based TOEIC preparation applications like *Santa TOEIC*¹ have widely been used in Korea, and more and more students have been relying on those applications for test preparation. Kim et al. (2020) and Loh et al. (2021) also reported that *Santa TOEIC* has received much attention as an AI-based TOEIC preparation application. They confirmed that it has played a role as an AI tutor increasing the students' actual test scores (Kim et al. 2020, Loh et al. 2021).

Scholars in other English learning settings have also investigated the effectiveness of AI technology and found that they are beneficial for improving students' English proficiency. In Japan, for example, Obari and Lambacher (2019), Obari (2020), and Obari, Lambacher, and Kikuchi (2020) studied two AI-based applications, *Google Home Mini* and *Amazon Alexa*, and reported that they were useful for increasing students' TOEIC scores. In Indonesia, Kusumaningrum and Pertiwi (2021) also found that AI applications such as *Listening for the TOEIC Test* can indeed increase students' TOEIC skills. The scholars have emphasized the educational value of AI-based applications in English learning environments.

Considering its positive effects on English learning, it seems inevitable that students will use AI technology in language learning settings (Jones et al. 2018). However, it is also important to note that human teachers support students' learning in ways that cannot be fully replicated through AI technology (Selwyn 2018). Hsu (2018) also pointed out that AI-based applications often fail to understand what has been said and cannot answer like a real

¹ Santa provides an All-in-one service in which you can study everything about TOEIC all at once, including TOEIC RC/LC practice questions, TOEIC video lectures, TOEIC vocabs, and TOEIC sample vocabulary.

human. They rarely produce human-like responses and need more language abilities. When the responses from AI are not appropriate, students might feel frustrated and embarrassed and their learning will be hampered (Kim et al. 2021).

Furthermore, according to Kim, Cha and Kim (2020), it is not easy for students to focus on AI applications due to the low tension. Students often complained that they were annoyed by the pop-up advertisements and had trouble concentrating on their learning activities. Another unfavorable aspect of AI technology was related to error correction including grammar check or spelling feedback. The authors reported that no correction was made by the AI applications when the students produced errors. In their study, students of the English language expressed that they wanted the AI to correct their errors as human teachers do.

As many students in Korea rely on AI technology for their English learning, they might not feel that they need English teachers and/or classroom learning in the near future. However, according to Jones et al. (2018), human teachers can teach real and authentic English, something that AI cannot do. AI tutors cannot support students' learning in ways that human teachers do, and they cannot fully replace human teachers (Selwyn 2018). Therefore, teachers should incorporate AI applications into their teaching by providing proper support to their students. Given that teacher support is an important factor that influences students' language proficiency (Luan et al. 2020), the role of human teachers seems pivotal in English learning environments.

Taking all this into consideration, the current study investigates the effects of teacher support on AI-based English learning. In particular, given that previous research has focused on AI-based applications and TOEIC score improvement (Kusumaningrum and Pertiwi 2021, Obari and Lambacher 2019, Obari 2020, Obari, Lambacher and Kikuchi 2020), the study examines the effects of AI applications on English grammar and vocabulary. In addition, the present study explores the relationship between different types of teacher support and self-regulated learning in AI-based English learning environments. Considering that empirical studies on AI chatbots are still rare in English learning settings (Kim, Cha and Kim 2020), the findings of this empirical study will provide teachers with efficient teaching methods in planning and implementing an AI-based English learning course.

3. Methodology

3.1 Participants

This study examined how teacher support can help learners improve their grammar and vocabulary when using an AI-based TOEIC application. In the fall semester of 2021, 121 university students who registered for the general English classes participated in the study. The classes were mandatory for freshmen using AI-based TOEIC applications to improve their TOEIC scores. Participants were randomly divided into three different classes which were conducted as online and offline classes using a particular online application for studying TOEIC once a week for two hours. The instructor provided three different types of support to each class: cognitive, emotional, and autonomy.

Table 1. Participants' Demographic Information

	Cognitive (<i>N</i> = 39)	Emotional (<i>N</i> = 41)	Autonomy (<i>N</i> = 41)
Gender	10 females 29 males	2 females 39 males	18 females 23 males
Department	2 Engineering 6 Social Science 26 Humanities 5 Arts	41 Engineering	3 Engineering 6 Social Science 11 Humanities 21 Arts

Participants' demographic information is shown in Table 1. Thirty-nine students were assigned as a cognitive support group, with 10 females and 29 males. Their majors varied and there were 2 students in the Department of Engineering, 6 students in the Department of Social Science, 26 students in the Department of Humanities, and 5 students in the Department of Arts. The emotional support group consisted of 41 students, with 2 females and 39 males. All the students in this group belonged to the Department of Engineering. The last group was the autonomy group which was comprised of forty-one students, with 18 females and 23 males. Their majors included 3 students in the Department of Engineering, 6 students in the Department of Social Science, 11 students in the Department of Humanities, and 21 students in the Department of Arts.

3.2 Procedure

These three classes were specifically designed for preparing for the TOEIC via an AI-based online program which was developed by JES (Janua Educational Services). This is an intelligent tutoring system (ITS) that interacts with students, presents information, and tests their knowledge (Psozka, Massey and Mutter 1988). This AI program also teaches each student individually based on his or her prior knowledge and priorities. Specifically, students engage in a diagnostic test and are provided with a differentiated curriculum following the test results before beginning their online learning. During the learning process within the AI-based program, data is analyzed for each individual student. Based on learners' traits and patterns, the program generates the required number of tasks and the amount of learning expected.

The role of the instructor in the assigned classes was to provide directions for using the program, to answer students' questions, and to guide students to use their time effectively. Students took classes both online and offline according to the COVID-19 regulations. The classes were conducted once a week for two hours. The program included vocabulary, grammar for reading comprehension, and listening sessions.

At the beginning of the semester, participants took a pre-test: vocabulary and grammar. Students were given a whole class period to take both tests (vocabulary and grammar) which took 15 minutes each. Questions for the vocabulary and grammar tests were selected from the AI-based TOEIC online program. Examples of each test are presented in Figure 1.

<p>Examples of Grammar Test</p> <p>1. Mr. Blacksmith ----- for this company for ten years by next year. (A) works (B) has worked (C) will have worked (D) will work</p> <p>2. The guest room has recently been renovated, but it still needs ----- repairs. (A) much (B) another (C) a few (D) each</p>
<p>Examples of Vocabulary Test</p> <p>1. She suggest to them modifying the payment <i>terms</i>. _____</p> <p>2. The parent company has decided to get out of the home <i>appliance</i> business. _____</p>

Figure 1. Examples of Grammar and Vocabulary Test

Students were provided with a test link via smartphones and they were under the instructor's control when taking the test. Then, they administered a pre-questionnaire about self-regulated learning. The class started with offline classes and continued until the semester ended except for two weeks when it was done via Zoom due to the CORONA-19 regulations. For the offline classes, students were instructed to bring their laptops and study. If they forgot to bring their laptops, they were allowed to use their smartphones. As for online classes via Zoom, students should turn on their cameras and self-studied using either their laptops or smartphones.

Table 2. Types of Teacher Support

Cognitive Teacher Support
The teacher provides some useful skills and methods to learn English.
When students encounter problems with learning English, the teacher provides clear explanation.
The teacher encourages and guides students to complete the task rather than tell them the answer too early.
Teachers can express concepts accurately, which helps students to understand the language and skills.
During the learning process, the teacher asked open and enlightening questions.
The teacher shows students how to use the online learning system/smartphone apps/technology for language learning.
Teachers can express concepts accurately, which helps students to understand the language and skills.
When students have problems with English, they get good help and guidance from their teachers.
Emotional Teacher Support
The teacher understands and cares about students.
The instructor conveyed confidence in students' ability to do well in the course.
When students don't do well on a test, the teacher encourages them to study harder to do better next time.
The teacher will give students praise or recognition for their progress or completion of their studies.
When students have problems, the teacher is willing to take the time to help them.
Teachers will give students suggestions on studying, which could help them build up their confidence.
The teacher pays attention to what students say and then responds to it.
Autonomy Support
The teacher allows them to give a different answer from the standard answer.
The teacher takes students' suggestions/opinions into consideration when preparing for his/her teaching.
The teacher encourages students to raise questions about what they have learned.
When learning this course, the teacher made students understand the importance of this course.
The teacher gives students enough time to arrange the online learning progress autonomously.
The teacher provides students with abundant online and offline resources for further learning.

Table 2 describes the list of three different types of teacher support. Based on the criteria displayed in Table 2, the instructor of the three classes provided appropriate teacher support to students in each assigned class.

During the semester, students in the cognitive and emotional support group were instructed to study on their own for at least 80 minutes without taking a break. Out of 120 minutes, students from both groups must study for at least 80 minutes per class from the beginning of the class. That is, they can leave the class only after they fill up their 80-minute time slot and finish studying the allotted content for the day. After students are finished, they received a text message from the program like, 'You're done for the day.' If students cannot finish the 'learning parts' they were supposed to do for the day in 80 minutes, they can work on it for another 40 minutes. A few students who could not finish their parts in 120 minutes were asked to complete at home as an assignment. If they studied for less than 80 minutes, it was considered absent by the school's regulations. However, students in the autonomy group were able to use their time freely within the time limit of two hours.

Regarding the resource, cognitive, and emotional support groups can not use any other resources such as online dictionaries but students in the autonomy group were allowed to use online dictionaries, online translators, and even use search engines such as Google. As for questions and answers, only students in the cognitive support group were permitted to ask any questions and their instructor provided appropriate responses to them. With regard to the

encouragement, the instructor provided emotional support such as ‘*well done,*’ ‘*You’re doing a great job,*’ ‘*You can do it,*’ ‘*Keep up the good work,*’ to the emotional support group only. Whenever students looked like they needed some help, the instructor encouraged them to work hard. In short, each group was treated with their own support types: students in the cognitive support group got a chance to ask questions, those who were assigned as emotional support group only received encouragement, and the final support group, the autonomy group had an opportunity to use Internet resources.

For the whole semester, students in each group tried to learn as best as they could using the AI-based TOEIC program. Before the semester ended, students took the post-tests of vocabulary and grammar. Also, they filled out the post-questionnaires about self-regulated learning and perception toward using an AI-based TOEIC program via Google survey link.

3.3 Data Instruments and Analysis

For this study, all data from the test scores and questionnaires were collected and analyzed. Students’ improvement in grammar and vocabulary knowledge was compared using pre- and post-test scores. The grammar test included 20 multiple-choice questions (20 points) and the vocabulary test consisted of 25 questions in which students had to write down the definition of each word (25 points). One point was assigned to each question.

The questionnaire responses of the students were gathered and analyzed. Thirty-six items were included to assess students’ ability to self-regulate their learning, and ten items to investigate students’ perceptions of an AI-based TOEIC online program.

The self-regulated learning questionnaire (SRLQ) was based on Ryu (2017). Table 3 depicts the SRLQ and its subcategories: metacognitive strategies, cognitive strategies, and resource management strategies. Each item was scored on a six-point Likert scale, with 1 being the least agreeable and 6 being the most agreeable. Cronbach’s alpha was used to determine the internal consistency and reliability of the questionnaire. The results reveal that Cronbach’s alpha for metacognitive strategies was 0.882 and 0.958, Cronbach’s alpha for cognitive strategies was 0.992 and 0.910 and finally, Cronbach’s alpha for resource management strategies was 0.897 and 0.899 on the pre- and post-questionnaire, respectively. This proved that the self-regulated learning questionnaire used in this study was reliable and each sub-strategies were internally consistent since the Cronbach’s alpha values were greater than 0.8.

Table 3. Self-Regulated Learning Questionnaire (SRLQ)

Learning Strategies	Category	#	# of items
Metacognitive strategies	Planning	1~5	5
	Monitoring	6~9	4
	Regulating	10~12	3
Cognitive strategies	Rehearsal	13~16	4
	Elaboration	17~19	3
	Organization	20~22	3
Resource management strategies	Time and study environment	23~28	6
	Effort regulation	29~32	4
	Help-seeking	33~36	4

All the data gathered from the tests and the questionnaires were analyzed using SPSS 24.0. First, a paired sample *t*-test was used to compare the means of the pre- and post-test for grammar and vocabulary scores across the three teacher support groups. The differential effects of teacher support were then investigated using a one-way analysis

of covariance (ANCOVA) since there was a significant difference in the pre-test. A one-way ANOVA analysis was also performed to determine whether there were any significant differences in students' use of self-regulated learning and their perceptions of the AI-based TOEIC program. Cronbach's Alpha was used to assess the reliability of students' perception scale. The scale has an alpha value of .912.

4. Results and Discussions

4.1 Grammar and Vocabulary Learning by Different Teacher Support

4.1.1 Improvement in Grammar and Vocabulary Learning

The aim of this study was to investigate whether the AI-based TOEIC program could be effective for learning grammar and vocabulary with different types of teacher support. The first research question was to examine the scores between the pre- and the post-tests for students' grammar and vocabulary after experiencing the program. Paired sample *t*-tests were employed to compare the pre- and post-test scores. Furthermore, to examine the differences in teacher support, ANOVA and ANCOVA were used to analyze the data.

Table 4 demonstrates the results of the pre- and post-tests for the three different teacher support groups. As for the cognitive support group, the mean score of the pre-test for grammar was 5.64 ($SD = 2.40$) while that of the post-test was 7.08 ($SD = 2.80$). Likewise, the mean score of the pre-test for vocabulary was 7.54 ($SD = 5.12$) and that of the post-test was 10.26 ($SD = 7.39$). There was a significant difference in both tasks for the cognitive support group. The emotional support group, whose average score was 6.41 ($SD = 2.61$) in the pre-grammar test, achieved an average score of 6.71 ($SD = 2.70$) on the post-test. They received 9.29 ($SD = 7.39$) on the pre-test and 12.83 ($SD = 8.61$) on the post-test for the vocabulary indicating a significant difference in scores. The autonomy group received a pre-test score of 5.88 ($SD = 2.73$) and a post-test score of 6.78 ($SD = 3.00$) on the grammar test. Regarding the vocabulary test, they received 4.22 on the pre-test and 11.10 on the post-test. That is, there was a significant difference in the vocabulary, but not in the grammar test. As a result, it is suggested that after one semester, all groups improved in terms of vocabulary. However, regarding the grammar, only the cognitive support group significantly improved.

Table 4. Result of Paired Sample *t*-tests for the Teacher Support

Support	Test		<i>M</i>	<i>SD</i>	<i>MD</i>	<i>df</i>	<i>t</i>	<i>p</i>
Cognitive	Grammar	pre	5.64	2.40	1.44	38	2.227	.029*
		post	7.08	2.80				
	Vocabulary	pre	7.54	5.12	2.72	38	2.081	.044*
		post	10.26	7.39				
Emotional	Grammar	pre	6.41	2.61	0.29	40	0.519	.607
		post	6.71	2.70				
	Vocabulary	pre	9.29	7.39	3.54	40	2.235	.031*
		post	12.83	8.61				
Autonomy	Grammar	pre	5.88	2.73	0.90	40	1.977	.055
		post	6.78	3.00				
	Vocabulary	pre	4.22	3.17	6.88	40	5.025	.000**
		post	11.10	8.36				

* $p < .05$, ** $p < .01$

In summary, the results show that the three groups' vocabulary knowledge significantly improved when compared to the beginning of the semester. That is when using an AI-based TOEIC program to learn vocabulary, students are influenced by teacher support: cognitive, emotional, and autonomy. Regarding grammar, students in the cognitive support group improved their scores indicating that the instructor plays an important role when students are learning grammar. In other words, when students study for the TOEIC via an online program, there may be parts of the grammar section that they do not understand necessitating a clear explanation from the teacher. However, students who belonged to the other two types of teacher support groups, emotional and autonomy groups, did not improve their grammar scores after learning with an AI-based TOEIC preparation program. That is, receiving only encouragement (emotional support) from the instructor without getting any comments on or responses to their questions did not lead to enhancing students' actual learning. Similarly, students in the autonomy group who had access to other resources like searching for things they did not understand also found it difficult to learn English grammar. Therefore, based on the findings, it was confirmed that teacher support, and especially cognitive support, was conducive to students' learning enhancement.

4.1.2 Group Differences in Grammar & Vocabulary Learning

To examine if the different teacher support modes could be attributed to the development of grammar and vocabulary learning, a one-way analysis of covariance (ANCOVA) was conducted. The descriptive statistics for the pre-test scores of the three groups are described in Table 5. To examine the homogeneity of the three types of teacher support groups, the participants' scores were analyzed in terms of grammar and vocabulary.

The result revealed that the mean score for grammar by the three groups was not statistically different ($p = .391$). Thus the significant difference proved that the emotional group excelled compared with the other two groups in the vocabulary test ($p < .01$) while the findings of the grammar category indicated that the three groups were homogeneous, though there was a significant difference in terms of vocabulary prior to the treatment. Therefore, an ANCOVA was carried out to identify which group performed better in the post-test.

Table 5. Group Differences of Teacher Support in the Pre-test

Test	Support	<i>M</i>	<i>SD</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
Grammar	Cognitive	5.64	2.40	12.651	2	6.326	0.946	.391
	Emotional	6.41	2.61					
	Autonomy	5.88	2.73					
Vocabulary	Cognitive	7.54	5.12	543.787	2	271.894	8.954	.000**
	Emotional	9.29	7.39					
	Autonomy	4.22	3.17					

** $p < .01$

To investigate the differences in vocabulary learning among the three groups, an ANCOVA was conveyed, as demonstrated in Table 6. The adjusted mean score of the pre-vocabulary was 7.01^a and the p -value was .466, which was not greater than the significance level of .05 ($F = .769$, $p = .466$). Therefore, it could be assumed that the vocabulary in the cognitive, emotional, and autonomy groups was approximately at the same level when the experiment took place. In other words, results for the post-test did not reveal that the teacher support had an effect on vocabulary knowledge when learning online.

Table 6. Group Differences (ANCOVA) in the Post-test (Vocabulary)

Test	Support	<i>M</i>	<i>SE</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
Vocabulary	Cognitive	10.13 ^a	1.30	100.286	2	50.143	.769	.466
	Emotional	12.28 ^a	1.30					
	Autonomy	11.76 ^a	1.32					

a. Covariates appearing in the model are evaluated at the following values: pre-vocabulary = 7.01

To explore the differences in grammar, a one-way ANOVA for the post-test was employed. Table 7 presents the results of the different teacher support groups for grammar. The mean score of the cognitive support group was 7.08, the emotional group was 6.71, and the autonomy group was 6.78. The findings demonstrated that there was no significant difference in the post-test scores between the three groups ($F = .188, p > .05$). Therefore, it could be assumed that the different teacher support groups were not a variable in determining the development of grammar or vocabulary knowledge.

Table 7. Group Differences (ANOVA) in the Post-test (Grammar)

Test	Support	<i>M</i>	<i>SD</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
Grammar	Cognitive	7.08	2.80	3.041	2	1.520	.188	.829
	Emotional	6.71	2.70					
	Autonomy	6.78	3.00					

The findings of the present study confirm the previous studies that AI technology can help improve learners' English skills (Kim, Cha and Kim, 2020, Yang and Kim 2021). Particularly, Jones et al. (2018) demonstrated that a lot of students use AI technology to prepare for TOEIC and even improved their scores (Loh et al. 2021). In this way, this AI-based TOEIC program can be one of the ways to more effectively guide students to study and enhance their English skills.

Moreover, in terms of teacher support within each group, the results of this study corroborate Yang and Kim's (2021) finding that cognitive support from their instructor helped them gain better performance than the emotional support and autonomy groups when learning vocabulary and grammar. Particularly, regarding grammar, significant improvement was found only in the cognitive support group. This can be attributed to the fact that getting cognitive support promoted learners' understanding of the concepts better (Chai and Gong 2013) and encouraged their learning curiosity (Lam and Law 2007). Also, Kazemi et al. (2017) stated that cognitive support can play an important role in enhancing students' linguistic abilities.

Although there was a significant difference within each teacher support group, when investigating the differences between the groups, no significant difference was found among the three types of teacher support. It can be assumed that each type of teacher support helps promote students' learning in some ways as suggested in the literature (Richland et al. 2016, Titsworth et al. 2010, Yang and Kim 2021), but students' improvement in grammar and vocabulary is not affected by teacher support. The findings of this study corroborate previous studies on the effects of different types of teacher support on language learning. For example, Yang and Kim (2021) found no significant difference between cognitive support and autonomy support regarding language proficiency improvement. Rajuan et al. (2008) also reported that emotional support was as effective as cognitive support. While this study confirmed the importance of using teacher support which can affect language proficiency (Luan et al. 2020), the effects of different teacher support types were not different from one another.

4.2 Students' Self-Regulated Learning by Different Teacher Support

The second research question was to investigate students' self-regulated learning which includes metacognitive strategies, cognitive strategies, and resource management strategies. The metacognitive strategies include planning, monitoring, and regulating. The cognitive strategies include rehearsal, elaboration, and organization; finally, the resource management strategies are related to time and study environment, effort regulation, and help-seeking.

Regarding the cognitive support group, the result was computed based on the rating scale of the questionnaire items in SRL (Self-Regulated Learning). As presented in Table 8, they showed significant differences between the pre- and post-stages in utilizing metacognitive strategies and cognitive strategies ($p = .03$, $p = .02$ respectively), while there was no significance in resource management strategies ($p = .19$). When compared to the beginning of the semester, the students in the cognitive support group used more self-regulated learning strategies at the end of the semester. That is, students may be encouraged to use specific strategies when learning online with cognitive support from a teacher.

Table 8. Result of Paired Sample *t*-tests for the Cognitive Support Group

Strategies	Stage	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Metacognitive	Pre	3.69	.62	-2.306	38	.03*
	post	3.94	.59			
Cognitive	Pre	3.61	.65	-2.510	38	.02*
	post	3.90	.57			
Resource management	Pre	3.73	.59	-1.347	38	.19
	post	3.87	.57			

* $p < .05$

Table 9 shows the results of a paired sample *t*-test for the emotional support group. It revealed that there were no significant differences between the pre- and post-stages ($p > .05$). This means that students' use of self-regulated learning strategies did not change significantly as a result of the teacher's emotional support over the semester.

Table 9. Result of Paired Sample *t*-tests for the Emotional Support Group

Strategies	Stage	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Metacognitive	Pre	3.56	.94	-.636	40	.52
	post	3.69	.95			
Cognitive	Pre	3.63	.94	-.907	40	.37
	post	3.80	.93			
Resource management	Pre	3.72	.91	.013	40	.99
	post	3.72	.90			

Regarding the autonomy group, the results of paired-sample *t*-tests are displayed in Table 10. As shown in the table, the mean score of the metacognitive strategies improved substantially from 3.63 to 4.03. Regarding cognitive strategies, the average mean was 3.57 in the pre-stage and got an average score of 4.04 in the post-stage. Not surprisingly, the *p*-values of the two strategies were below .05. However, as for the resource management strategies, they received a mean of 3.63 and 3.89 in the post-stage respectively. Therefore, it is suggested that autonomy group expanded the use of metacognitive and cognitive strategies during the whole semester.

Table 10. Result of Paired Sample *t*-tests for the Autonomy Group

Strategies	Stage	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>p</i>
Metacognitive	Pre	3.63	.88	-3.02	40	.00**
	post	4.03	.64			
Cognitive	Pre	3.57	.95	-2.83	40	.01*
	post	4.04	.63			
Resource management	Pre	3.63	.77	-1.67	40	.10
	post	3.89	.70			

** $p < .01$, * $p < .05$

To examine whether there was any significant difference in using self-regulated learning strategies after using an AI-based TOEIC program, the pre- and post-questionnaires were calculated in terms of metacognitive strategies, cognitive strategies and resource management strategies. To measure the differences of the three groups before the experiment, an ANOVA was employed. Table 11 indicates the inferential analysis and descriptive statistics for each sub-category. According to the pre-questionnaire results, there were no significant differences in how the three groups used self-regulated learning strategies.

Table 11. Result of ANOVA for the Pre Self-Regulated Learning Strategies

Strategies	Support	<i>M</i>	<i>SD</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
Metacognitive	Cognitive	3.69	.62	.332	2	.166	.243	.785
	Emotional	3.56	.94					
	Autonomy	3.63	.88					
Cognitive	Cognitive	3.61	.65	.055	2	.027	.037	.964
	Emotional	3.63	.94					
	Autonomy	3.57	.95					
Resource management	Cognitive	3.73	.59	.252	2	.126	.212	.809
	Emotional	3.72	.91					
	Autonomy	3.63	.77					

Cognitive ($N = 39$), Emotional ($N = 41$), Autonomy ($N = 41$)

Next, to investigate whether teacher support could be attributed to the difference in self-regulated learning in a statistically significant way, an ANOVA was run on the post-questionnaire. The descriptive statistics for the means are reported in Table 12.

Table 12. Result of ANOVA for the Post Self-Regulated Learning Strategies

Strategies	Support	<i>M</i>	<i>SD</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
Metacognitive	Cognitive	3.94	.59	2.562	2	1.281	2.300	.105
	Emotional	3.69	.95					
	Autonomy	4.03	.64					
Cognitive	Cognitive	3.90	.57	1.282	2	.641	1.201	.305
	Emotional	3.80	.93					
	Autonomy	4.05	.63					
Resource management	Cognitive	3.87	.57	.707	2	.354	.649	.525
	Emotional	3.72	.90					
	Autonomy	3.89	.70					

Cognitive ($N = 39$), Emotional ($N = 41$), Autonomy ($N = 41$)

As shown in Table 12, the three groups did not show any significant differences in using metacognitive strategies, cognitive strategies, and resource management strategies. In terms of metacognitive strategies, the cognitive support group had a mean of 3.94, the emotional support group had a mean of 3.69, and the autonomy group had a mean of 4.03, with a p -value of less than a significant level. In addition, the results for cognitive strategies revealed that the p -values were greater than .05 ($F = 1.201, p = .305$). Similarly, in terms of resource management strategies, students in the cognitive support group scored a mean of 3.87, those in the emotional support group scored a mean of 3.72, and those in the autonomy group scored a mean of 3.89 ($F = .649, p = .525$).

To summarize, the findings of this study demonstrated that the use of self-regulated learning strategies was apparent in the cognitive support group and the autonomy support group, but not in the emotional support group. Specifically, both metacognitive strategies (planning, monitoring, and regulating) and cognitive strategies (rehearsal, elaboration, and organization) improved in both the cognitive and autonomy support groups, while there were no significant differences in resource management strategies (time and study environment, effort regulation, and help-seeking) in any of the three groups. Previous research (Persico and Steffens 2017, Turan and Demirel 2010) lends some support to this study's findings that technology-based learning can promote self-regulated learning and that improving students' self-regulated learning skills can improve their academic performance.

Regarding the effects of teacher support within groups, the current study supports the previous research indicating that autonomy support was more effective than emotional support (Dincer et al. 2012, Liu et al. 2017). Yang and Kim (2021) also noted the superior effects of cognitive support over emotional support in this context. In this vein, the findings of this study also showed the apparent use of self-regulated learning strategies in the cognitive and the autonomy support groups, but not in the emotional support group.

In addition, when the use of self-regulated learning strategies was assessed based on three types of teacher support, no significant differences were found, according to the data analysis. That is, this study did not prove that self-regulated learning strategies differed based on the three types of teacher support at the end of the semester. The students who received various types of teacher support did not use self-regulated learning strategies differently. These findings also support the previous research indicating that the effects of teacher support do not differ depending on the types of teacher support. As Rajuan et al. (2008) confirmed, emotional support is as effective as cognitive support, and Yang and Kim (2021) reported that the effects of cognitive support did not differ from those of autonomy support. From the current study, it can be said that it is meaningless to focus on one type of teacher support for students' self-regulated learning.

4.3 Perceptions Toward an AI-based Online TOEIC Program by Teacher Support Mode

To measure student perceptions of an AI-based online TOEIC program according to different types of teacher support, a post-questionnaire was conducted at the end of the semester. The results of the ANOVA were revealed in Table 13. Ten items in the questionnaire were described and explained along with the descriptive statistics and inferential analysis.

As for the first item, *“I was satisfied with the digital learning device while taking the online TOEIC English course,”* the means in the cognitive support group was 4.03, 3.17 in the emotional support group, and 4.80 in the autonomy group. The second item, *“There was no problem accessing the online TOEIC English course.”* The cognitive support group value was 4.58, the emotional support group value was 3.56, and the autonomy group value was 4.95. The cognitive support group scored 4.00 on the third item, *“The response time of the online TOEIC learning was appropriate for learning.”* The emotional support group scored 2.98, and the autonomy group scored 4.22. As for the fourth item, *“The platform and content of the online TOEIC English course helped me learn English,”* received a score of 4.58 in the cognitive support group, 3.15 in the emotional support group, and 4.25 in the autonomy group. The fifth item, *“I was satisfied with the functions provided by the online TOEIC English course,”* had a mean of 3.74 in the cognitive support group, 3.05 in the emotional support group, and 4.08 in the autonomy group. The cognitive support group received a score of 4.15, the emotional support group received a 3.27, and the autonomy group received 4.20 for the sixth item, *“Online courses in TOEIC English were easy and convenient.”* The cognitive support group was 4.56, the emotional support group was 3.24, and the autonomy group was 4.46 for the seventh item, *“In the online TOEIC English course, I was able to see the page I wanted to access right away.”* Concerning the eighth item, *“It was convenient to learn English via online TOEIC English course,”* the cognitive support group got an average of 4.49, the emotional support group got an average of 3.00, and the autonomy group got an average of 4.63. The cognitive support group received 3.97 on the ninth item, *“If possible, I would like to use online English classes.”* The emotional support group received a score of 2.78, while the autonomy group received a score of 3.88. The cognitive support group was 3.82, the emotional support group was 2.73, and the autonomy group was 4.20 for the final item, *“If possible, I would like to take online courses in classes other than English classes.”*

ANOVA results were used to compare the means of the three teacher support groups. As shown in Table 13, the *p*-values for all items were greater than a significant level of .05. To be more specific, the difference between the cognitive and emotional support groups, as well as the difference between the emotional support and the autonomy groups, was significant. Surprisingly, the emotional support group had lower means in all items than the other groups. In comparison to the other two groups, students who received emotional support from the teacher were likely dissatisfied with the program and online TOEIC learning. Furthermore, these students may have believed that emotional support was insufficient to assist them in learning or improving their scores using an online TOEIC program.

Table 13. Result of ANOVA for the Post-Survey of Students' Perceptions

	Support	<i>M</i>	<i>SD</i>	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
1	Cognitive	4.03	1.04	54.79	2	27.39	20.38	.00**
	Emotional	3.17	1.50					
	Autonomy	4.80	.81					
2	Cognitive	4.58	1.18	42.33	2	21.16	12.06	.00**
	Emotional	3.56	1.45					
	Autonomy	4.95	1.32					
3	Cognitive	4.00	.97	35.69	2	17.85	13.75	.00**
	Emotional	2.98	1.37					
	Autonomy	4.22	1.01					
4	Cognitive	4.58	.68	45.04	2	22.52	16.14	.00**
	Emotional	3.15	1.48					
	Autonomy	4.25	1.21					
5	Cognitive	3.74	1.16	22.25	2	11.13	6.26	.00**
	Emotional	3.05	1.47					
	Autonomy	4.08	1.35					
6	Cognitive	4.15	.82	21.13	2	10.57	6.44	.00**
	Emotional	3.27	1.43					
	Autonomy	4.20	1.36					
7	Cognitive	4.56	.75	43.48	2	21.74	19.57	.00**
	Emotional	3.24	1.43					
	Autonomy	4.46	.82					
8	Cognitive	4.49	.85	65.81	2	32.90	32.32	.00**
	Emotional	3.00	1.32					
	Autonomy	4.63	.74					
9	Cognitive	3.97	1.00	35.48	2	17.739	11.64	.00**
	Emotional	2.78	1.44					
	Autonomy	3.88	1.21					
10	Cognitive	3.82	1.19	47.27	2	23.636	14.66	.00**
	Emotional	2.73	1.53					
	Autonomy	4.20	1.03					

Cognitive ($N = 39$), Emotional ($N = 41$), Autonomy ($N = 41$); ** $p < .01$

The total means in the cognitive and autonomy support groups addressing students' perspectives on an AI-based TOEIC program were higher than those in the emotional support group. This finding implies that learners who received cognitive or autonomy teacher support were more likely to prefer it over learners who received emotional teacher support. As a result, when learning using an online TOEIC program, it is necessary to consider how to assist and guide students to perform better in the long run.

To sum up, recently, AI-based English learning has become popular in Korea and many educators regard it as an alternative to traditional English classes (Jones et al. 2018). However, based on the findings of the students' perceptions, teacher support is still vital to students' academic development, including not only learning outcomes but also affective or emotional outcomes (Lei, et al 2018). According to Yang and Kim (2021), students had positive attitudes toward AI technology for English learning. While AI technology can aid in certain aspects of learning, it may be too soon to replace teachers (Selwyn 2018). As a result, rather than focusing on one type of teacher support, educators should incorporate all three types of teacher support, cognitive, emotional, and autonomy, into their instruction to improve students' performance in the English learning environment.

5. Conclusion

AI-based applications are increasingly being implemented in most business and educational settings. Furthermore, it is no exaggeration to suggest that such a wide range of great programs interest students and parents, affecting the educational field and re-establishing the role of teachers. In this regard, the current study sought to investigate differences in teacher support in developing Korean college students' grammar and vocabulary knowledge when students were preparing for the TOEIC using an AI-based program.

One hundred and twenty-one students who enrolled in the mandatory English online TOEIC course participated in the study. They were assigned to three different classes and each received different teacher support: cognitive teacher support, emotional teacher support, and autonomy support. It employed a pre- and post-test design to gauge students' progress in TOEIC grammar and vocabulary. The pre-test, an AI-based TOEIC online course, and post-test were all held during the fall semester of 2021. While students were completing learning activities or asking questions throughout the course, the teacher provided various types of assistance depending on each group (cognitive, emotional, and autonomy). That is, students who received cognitive teacher support received clear explanations, good help and guidance, and direction, whereas those who received emotional teacher support were only encouraged to study harder in order to do better, or to express confidence in their ability to do well in the course. Furthermore, students who received autonomy support were given enough time to plan and organize their own online learning progress.

Concerning the first research question, the findings show that the three groups' vocabulary knowledge improved significantly when compared to the beginning of the semester. Students improved their vocabulary after studying for the TOEIC for a semester using the AI-based program. To put it another way, regardless of the types of teacher support provided, vocabulary knowledge improved at the end of the semester compared to the beginning. In terms of grammar, the cognitive support group only improved their scores, whereas students who received emotional and autonomy support from their teachers did not show any significant improvement. The two groups did not demonstrate any improvement in grammar learning after using this program, nor did they demonstrate any significant differences between the types of teacher support. As a result, the AI program produced varying results depending on the learning content, and it appears that different types of teacher support had no effect on either vocabulary or grammar learning. Specifically, AI-based online programs do not provide successful grammar learning to EFL learners without teacher's clear explanation or instruction. It can be concluded that a role of the teacher is important and required for grammar learning to take place. Improvement in vocabulary and grammar can occur when learning in AI-based online learning programs, but it cannot be said that there is a difference in learning effect according to the type of teacher support.

The second research question focused on the changes of self-regulated learning strategies in AI-based TOEIC online learning. To address the second research question, self-regulated learning strategies were classified into three categories and analyzed: metacognitive strategies, cognitive strategies, and resource management strategies. The results showed that the cognitive support and autonomy groups used different metacognitive and cognitive strategies between the pre- and post-stages, but there was no significant difference in resource management strategies. Students in both groups used more self-regulated learning strategies at the end of the study when compared to the beginning. That is, students may have been encouraged to use specific strategies when learning online with cognitive or autonomy support from a teacher. In the emotional support group, however, no significant differences were found between the pre- and post-stages. This means that emotional teacher support had no effect on the students' use of self-regulated learning strategies. According to the post-questionnaire results, there were no significant differences in how the three groups used self-regulated learning strategies. This implies that there is

no discernible difference in students' use of self-regulated learning strategies based on the different types of teacher support received. Self-regulated learning is an important aspect of online learning, and students should develop more effective online learning strategies to achieve learning objectives. As a result of this study, we can conclude that different types of teacher support have no effect on the learners' self-regulated learning strategies. However, the use of learning strategies may improve depending on the type of teacher support provided, so teachers will need to provide various forms of support in online learning.

The third research question was to investigate students' attitudes toward the AI-based online TOEIC program. According to the findings, there were significant differences between the cognitive, emotional, and autonomy support groups. Surprisingly, the mean scores of the emotional support group were lower than the other two groups across all items. The group that received emotional support from the teacher was assumed to be dissatisfied with the program and with the online TOEIC learning system compared with the other two groups. In other words, cognitive support or autonomy support was more effective than emotional support in dealing with students' perceptions of the AI-based TOEIC program. As a result, it is necessary to consider how teachers will assist students when using such an online learning program.

This study has several limitations. First, this study confirmed that an AI-based TOEIC program was effective for developing self-regulated learning strategies. The study, however, was only conducted with one university for a short period of time. In this regard, the future study would be more convincing if it included a large sample size of students from different universities over a longer period. Second, this research was restricted to a specific level of learners. As a result, the findings may not apply to all levels of Korean university students because it was conducted on a small number of students at a university. Furthermore, it only investigated English grammar and vocabulary learning; thus, other skills such as reading, writing, speaking, and listening must be taken into account. Finally, if students' subjective opinions about AI-based TOEIC programs were included, it would have provided more insightful suggestions about the effective use of the programs.

Despite its limitations, this study provides valuable insights. First, the study confirmed the significant role of teacher assistance in developing grammar knowledge. Such findings have the potential to improve learning outcomes through the use of AI-based online English-language contexts. Furthermore, different types of teacher support in an online English learning environment can help promote students' language learning as well as emotional aspects like interest, motivation, confidence, and learner autonomy. Self-regulated learning strategies can likewise have an impact on online learning, and effectively implementing these strategies necessitates a variety of types of teacher support, which will successfully lead learners to more effective online language learning.

References

- Caplan, G. 1974. *Support Systems and Community Mental Health: Lectures on Concept Development*. Behavioral Publications.
- Chai, X. Y. and S. Y. Gong. 2013. The development of questionnaire on perceived mathematics teacher support for middle school students. *Studies of Psychology and Behavior* 11(4), 511-517. DOI: CNKI:SUN:CLXW.0.2013-04-015
- Dincer, A., S. Yesilyurt and M. Takkac. 2012. The effects of autonomy-supportive climates on EFL learner's engagement, achievement and competence in English speaking classrooms. *Procedia-Social and Behavioral Sciences* 46, 3890-3894. DOI: 10.1016/j.sbspro.2012.06.167
- Gilfert, S. 1996. A review of TOEIC. *The Internet TESL Journal* 2(8), 1-8.

- Hsu, C. C. 2018. Artificial intelligence in smart tourism: A conceptual framework. In *Proceedings of The 18th International Conference on Electronic Business*, 124-133. ICEB, Guilin, China, December 2-6.
- Jones, S., A. Richards, Y. Cho and Y. J. Lee. 2018. The effect of the fourth industrial revolution on general English education: A case study of native English instructors' perceptions at a Korean university. *Korean Journal of General Education* 12(2), 169-197.
- Kazemi, Z., A. Zarehmoghadam and H. Emami. 2016. The role of perceived teacher's support and motivational orientation in prediction of metacognitive awareness of reading strategies in learning English. *Research in English Language Pedagogy* 5(1), 17-26.
- Kiefer, S. M., K. M. Alley and C. R. Ellerbrock. 2015. Teacher and peer support for young adolescents' motivation, engagement, and school belonging. *RMLE Online* 38(8), 1-18. DOI: 10.1080/19404476.2015.11641184
- Kim, B., H. Suh, J. Heo and Y. Choi. 2020. *AI-driven interface design for intelligent tutoring system improves student engagement*. In *Woodstock '18: ACM Symposium on Neural Gaze Detection*, June 3-5, 2018, Woodstock, NY. <https://doi.org/10.1145/1122445.1122456>
- Kim, H.-S., Y. Cha and N. Y. Kim. 2020. Students' perspectives on pre-recorded video lectures versus video-conferencing lectures in the untact era. *Journal of Research in Curriculum & Instruction* 25(2), 164-178. <https://doi.org/10.24231/rici.2021.25.2.164>
- Kim, H. S., N. Y. Kim and Y. Cha. 2021. Is it beneficial to use AI chatbots to improve learners' speaking performance?. *The Journal of Asia TEFL* 18(1), 161-178.
- Kim, N.-Y. 2019. Effects of mobile phone use on aviation students' English learning. *Journal of the Korea Academia-Industrial Cooperation Society* 20(5), 213-221.
- Kim, N.-Y. 2020. The effects of the use of captions on low-and high-level EFL learners' speaking performance. *Linguistic Research* 37, 135-161.
- Kim, T.-Y. 2009. The dynamics of L2 self and L2 learning motivation: A qualitative case study of Korean ESL students. *English Teaching* 64(3), 49-70.
- Kusumaningrum, M. A. D. and D. R. Pertiwi. 2021. An intelligent tutoring system for learning listening TOEIC. *Jurnal Berdaya Mandiri* 3(1), 456-467. <https://doi.org/10.31316/jbm.v3i1.1336>
- Lam, S. F. and Y. K. Law. 2007. The roles of instructional practices and motivation in writing performance. *The Journal of Experimental Education* 75(2), 145-164. DOI: 10.3200/jexe.75.2.145-164
- Lei, H., Y. Cui and M. M. Chiu. 2018. The relationship between teacher support and students' academic emotions: A meta-analysis. *Frontiers in Psychology* 8, 2288.
- Liu, B., W. L. Zhang and J. L. Liu. 2017. Study on the effect of teacher support on online learners' learning engagement. *E-Education Research* 11, 63-68+80. DOI: 10.13811/j.cnki.eer.2017.11.010
- Loh, H., D. Shin, S. Lee, J. Baek, C. Hwang, Y. Lee, ... and Y. Choi. 2021. *Recommendation for Effective Standardized Exam Preparation*. In *LAK21: 11th International Learning Analytics and Knowledge Conference*, 397-404. <https://doi.org/10.1145/3448139.3448177>
- Luan, L., J.-C. Hong, M. Cao, Y. Dong and X. Hou. 2020. Exploring the role of online EFL learners' perceived social support in their learning engagement: A structural equation model. *Interactive Learning Environments*, Advance Online Publication, 1-12. DOI: 10.1080/10494820.2020.1855211
- Malecki, C. K. and M. K. Demary. 2002. Measuring perceived social support: Development of the child and adolescent social support scale (CASSS). *Psychology in the Schools* 39(1), 1-18. DOI: 10.1002/pits.10004
- Mitchell, S. and J. DellaMattera. 2011. Teacher support and student's self-efficacy beliefs. *Journal of Contemporary Issues in Education* 5(2), 24-35. DOI: 10.20355/e5x30q
- Obari, H. 2020. The impact of AI on teaching EFL in Japan. *The Aoyama Journal of Economics* 71(4), 29-40.

- Obari, H. and S. Lambacher. 2019. Improving the English skills of native Japanese using artificial intelligence in a blended learning program. In F. Meunier, J. Van de Vyver, L. Bradley and S. Thoučsny, eds., *CALL and Complexity: Short Papers from EUROCALL 2019*, 327-333. Research-publishing.net. <https://doi.org/10.14705/rpnet.2019.38.1031>
- Obari, H., S. Lambacher and H. Kikuchi. 2020. The impact of using AI and VR with blended learning on English as a foreign language teaching. In K.-M. Frederiksen, S. Larsen, L. Bradley and S. Thoučsny, eds., *CALL for Widening Participation: Short Papers from EUROCALL 2020*, 253-258. Research-publishing.net. <https://doi.org/10.14705/rpnet.2020.48.1197>
- Park, J. H. and N. M. Shin. 2017. Students' perceptions of artificial intelligence technology and artificial intelligence teachers. *The Journal of Korean Teacher Education* 34(2), 169-192.
- Persico, D. and K. Steffens. (2017). Self-regulated learning in technology enhanced learning environments. In E. Duval, M. Sharples and R. Sutherland, eds., *Technology Enhanced Learning*, 115-126. Springer, Cham. https://doi.org/10.1007/978-3-319-02600-8_11
- Piechurska-Kuciel, E. 2011. Perceived teacher support and language anxiety in Polish secondary school EFL learners. *Studies in Second Language Learning and Teaching* 1(1), 83-100. DOI: 10.14746/ssl1t.2011.1.1.5
- Pсотka, J., L. D. Massey and S. A. Mutter. Eds., 1988. *Intelligent Tutoring Systems: Lessons Learned*. Lawrence Erlbaum Associates, Inc.
- Rajuan, M., D. Beijaard and N. Verloop. 2008. Student teachers' perceptions of their mentors as internal triggers for learning. *Teaching Education* 19(4), 279-292. DOI: 10.1080/10476210802339951
- Richland, L. E., K. N. Begolli, N. Simms, R. R. Frausel and E. A. Lyons. 2016. Supporting mathematical discussions: The roles of comparison and cognitive load. *Educational Psychology Review* 29(1), 41-53. DOI: 10.1007/s10648-016-9382-2
- Ryu, J. 2017. The effects of digital textbooks on college EFL learners' self-regulated learning. *Multimedia-Assisted Language Learning* 20(4), 99-126.
- Skinner, E. A. and M. J. Belmont. 1993. Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology* 85(4), 571-581. DOI: 10.1037/0022-0663.85.4.571
- Skinner, E., C. Furrer, G. Marchand and T. Kindermann. 2008. Engagement and disaffection in the classroom: Part of a larger motivational dynamic? *Journal of Educational Psychology* 100(4), 765-781.
- Selwyn, N. 2018. Six reasons Artificial Intelligence technology will never take over from human teachers. Retrieved from <http://www.aare.edu.au/blog/?p=2948>
- Song, S.-Y. 2017. The prospect and ethical reflection of relationship between AI robots and human beings. *The Journal of English Cultural Studies* 10(3), 61-83.
- Titsworth, S., M. M. Quinlan and J. P. Mazer. 2010. Emotion in teaching and learning: Development and validation of the classroom emotions scale. *Communication Education* 59(4), 431-452. DOI: 10.1080/03634521003746156
- Turan, Z. and O. Demirel. 2010. The relationship between self-regulated learning skills and achievement: A case from hacettepe university medical school. *H. U. Journal of Education* 38, 279-291.
- Wellborn, J. G. and J. P. Connell. 1987. *Manual for the Rochester Assessment Package for Schools*. University of Rochester.
- Wentzel, K. R., A. Battle, S. L. Russell and L. B. Looney. 2010. Social supports from teachers and peers as predictors of academic and social motivation. *Contemporary Educational Psychology* 35(3), 193-202.
- Yang, T. and N. Y. Kim. 2021. Effects of teacher support on Chinese EFL university students' listening ability in

a blended learning environment. *Journal of Digital Convergence* 19(12), 63-77. DOI: 10.14400/JDC.2021.19.12.063

Examples in: English
Applicable Languages: English
Applicable Level: All