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The impact of technology-based and non-technology-based vocabulary learning activities on the pushed output vocabulary learning of Saudi EFL learners

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The output hypothesis, proposed by Swain, plays a crucial role in language learning. It emphasizes the importance of learners' production (output) alongside comprehensible input. Pushed output, which reflects the accurate and concise language use of learners, has gained popularity in classrooms. Simultaneously, integrating technology into teaching has become important. However, research on how technology and pushed output impact vocabulary learning remains limited. This study examines the effects of three scenarios—pushed email, a pushed class, and a non-pushed class—on vocabulary development. 'Within-subject design' means each participant in the study experienced these three scenarios in a different order. Data was collected using diverse approaches. Productivity and vocabulary knowledge ratings were used to answer the set research questions. A total of 54 third-year adult Saudi EFL students at Albaha University participated. The participants were taught with no pushed output, with pushed output, and with email-pushed output in three groups, in three contexts, and using three target lexical item sets. In the productive and Vocabulary Knowledge Scales (VKS) tests, learners who completed vocabulary learning with pushed output performed better in the short and long terms. The email and pushed output outside class scenarios had a greater effect than in class. The findings urge further research into long-term technology-enhanced vocabulary learning exercises for speaking skills utilising the pushed output technique. Such studies could expand the sample and compare findings across Middle Eastern nations.

KEYWORDS

output hypothesis, pushed output, vocabulary learning, technology adoption, email pushed output

1 Introduction

The importance of acquiring vocabulary in a second language (L2) for communicative competence and language mastery is well-established (Nation and Webb, 2011). Acquiring L2 vocabulary is fundamental for developing communicative competence and achieving language mastery (Schmitt, 2008). Additionally, it significantly enhances reading comprehension (Nation, 2001). Yet despite its importance, students often find it difficult to expand their

vocabulary, and instructors tend to allocate limited class time to this crucial task (Waring and Nation, 2004; Webb and Chang, 2012).

Immersion strategies help learners identify lexical gaps between intended and actual speech (Swain, 1985). Improvisation often causes these gaps, leading to incorrect usage (Willis, 2003). Immersion fosters metalinguistic skills, enabling self-assessment and error detection, especially in cooperative activities (Stetsenko and Arievidt, 1997). This approach not only bridges lexical gaps but also encourages students to use the target language, enhancing immersion effectiveness.

Pushed output, where learners recognise and correct their mistakes, has the potential to improve language abilities more than non-pushed output, which either corrects them directly or not at all. The use of technology, which became prominent during the COVID-19 pandemic, supports the potential of pushed output by allowing learners to track and review their work (Ware and Warschauer, 2006). Technology personalises instruction and meets diverse learner needs (Blake, 2000), motivating and developing language skills.

Technology, including online conferencing, blogs, and emails, enhances vocabulary acquisition and output (Allagui, 2014; Avci and Adiguzel, 2017). Email, as an example of technology, has been shown to help students self-correct and improve accuracy (Nazari and Niknejad, 2015). Pushed output, which requires learners to produce accurate and precise language, can be effectively utilised via email (Swain, 1985; Ellis, 2003). Using pushed output through email encourages student responses to instructor-assigned tasks, leveraging technology in the classroom.

2 A review of the literature on pushed output and technology in vocabulary learning

Swain's idea of pushed output states that language learners must be encouraged to produce appropriate, correct, and sophisticated language to progress (McDonough, 2005). Pushed output is believed to benefit language acquisition in the contextualising and transforming stages of development (Swain, 1995; Setyaningsih et al., 2021). Swain noted that immersing students affords few opportunities to discuss *meaning* in the classroom, and thus he emphasised the need to encourage outside-the-classroom output as motivation for learning. According to Alfarwan (2022), knowledge gaps, which can be filled by more learning, reinforce the idea that pushed production is positive. According to Swain's output theory (Wright, 2016), promoted output enhances linguistic knowledge management and internalisation, as well as fluency, gap identification, and hypothesis testing.

Research has shown that pushed output improves L2 learning. Shintani (2011) found that input and output exercises improve ESL learners' productive and receptive vocabulary. In comparison to the control group, in Birjandi and Mamaghani's (2014) study, English verb tenses were acquired more effectively by groups who had immediate and delayed written pushed output. Although there is no clear consensus, most studies in fact contend that pushed output improves L2 accuracy and vocabulary. Yet more research is needed to fully understand pushed output and its appropriate use in L2 learning.

A number of studies on pushed production and vocabulary learning have revealed credible results. De la Fuente (2002) found that 32 intermediate English-speaking Spanish L2 learners who provided

output outperformed those who produced input in productive vocabulary. Shintani (2011) found that input and output improved vocabulary learning in 36 Japanese EFL learners. Oral pushed output promoted listening comprehension and active vocabulary acquisition more than written output, according to Hazrat and Hessamy (2013). Pushed output teaching improved accuracy but not fluency, according to Beniss and Bazzaz (2014).

The methodologies used in these investigations will be examined here. In De la Fuente's (2003) study at Georgetown University, 32 English-native L2 intermediate learners studying Spanish expected to provide output performed better than those who were asked to produce only input in vocabulary exams. The main language plan divided them into three groups and provided 90h of formal L2 education. The students were randomly allocated to negotiated input with output, without output, and non-negotiated input courses. Only 28 students completed all three post-tests after the initial inquiry period.

Al-Ghazo and Taamneh (2017) explored how pushed output might affect Jordanian language students' reading ability. Sixty language and literature students were divided into two groups of 30 for two English reading comprehension courses. The researchers designed a multiple-choice questionnaire to assess the students' reading comprehension. Lexical items and reading comprehension tests were given. The pushed output in the experimental group was activity-based, in contrast to the control group. The experimental group had better post-test scores than the control group. These results showed that pushed output hypothesis-based instruction improved reading comprehension and performance.

Namaziandost et al. (2019a) examined how output and input activities affected 54 Iranian L2 students' vocabulary acquisition at a private language school. The students were divided into output-based, input-based, and control groups. A productive vocabulary pre-test was done by each group. Nine fifty-minute sessions were then given to the output-and input-based groups. Following the treatment, a productive vocabulary post-test was administered to all three groups. To examine how input and output-based activities affected the students' vocabulary memory, a delayed post-test was given two weeks later. Both the post-test and the delayed-post-test demonstrated that the groups receiving the input and output performed better than the control group. However, there was little difference between the output and input groups.

Azizi's (2016) study revealed different results from those in Namaziandost et al. (2019a). In a private English language school in Tehran, Azizi (2016) contrasted the outcomes of 43 adult intermediate L2 students across three groups: those who did not negotiate, those who engaged in input negotiation without output, and those who pushed for output. Thirty students who obtained scores one standard deviation above or below the mean on the Preliminary English Test were selected randomly and allocated equally among the three groups. All treatment and procedures took 10 sessions. After the treatment, written and oral tests were given. Negotiation improved targeted L2 lexical production and understanding. Vocabulary development in L2 was not enhanced by pushing output beyond that of input negotiation without output.

Lopez (2020) examined how pushed output affected L2 oral production in 16 Colombian private school 7th-grade English language learners. The students were allocated randomly to either an output or a non-output group. The comprehension group engaged in

non-output exercises for five weeks, whereas the output group performed oral pushed exercises. The data was collected via interviews, stimulated recollections, and audio recordings. As demonstrated by the results, one-way pushed-output activities allowed students to produce a greater variety of oral output than two-way exercises. Syntactic and semantic uniformity may also be achieved through the use of joining procedures. Additionally, the learners believed oral forced output affected their L2 oral production and exposed them to L2 vocabulary, voice and structure.

In conclusion, promoting production may improve vocabulary retention, supporting the pushed output method. Further factors, including classroom atmosphere, might exert an influence on the utilisation of technology and vocabulary. As [Jafari and Chalak \(2016\)](#) stated, increasing technology usage in an interactive setting may help foster cognitive processes for vocabulary growth and self-correction. When students are required to generate and revise output, whether in person or electronically, their output will be more accurate and concise and they will use more words to express ideas, opinions, and descriptions. As noted above, employing technology will allow pupils to interact and reflect on their language. Digital media are expected to deliver more advantages due to the less stressful learning environment, even if face-to-face learning offers many of the same options.

Prior studies have found that pushing output enhances vocabulary acquisition (refer to the aforementioned studies). Limited research has been conducted on the topic of pushed output in vocabulary learning. Thus, the present study employs a mixed methods approach, incorporating qualitative and quantitative data, to examine the learning of abstract nouns and verbs among Saudi English major university students at the intermediate level. The research spanned both the short term (immediate learning outcomes observed shortly after the intervention) and the long term (retention and use of vocabulary over an extended period).

The development of abstract nouns and verbs among Saudi English major university students at the intermediate level is a critical component of language learning and comprehension. The significance of comprehending the neural representation and processing of abstract and concrete words, particularly nouns and verbs, in language comprehension is underscored by research in cognitive neuroscience and linguistics ([Barsalou et al., 2018](#)). The importance of examining the brain's processing of linguistic categories is underscored by research that has demonstrated that abstract concepts significantly engage language development ([Barsalou et al., 2018](#)). In addition, neural evidence suggests that learning abstract concepts typically involve a greater degree of affective processing than concrete concepts, suggesting a more profound level of cognitive engagement with abstract linguistic elements ([Shea, 2018](#)). By investigating the neural correlates of abstract verb processing and the cortical signatures of noun and verb production, researchers can acquire valuable insights into language acquisition and comprehension at a cognitive level. This will provide a more profound understanding of language development among Saudi English major university students at the intermediate level.

Several studies have examined digital habits, notably messaging apps. These studies, examining overall language development in terms of motivation and spelling/writing (not pushed output or in-class/out-of-class differences), have demonstrated the utility of technology in this area. The next sections will explain how a limited number of studies on technology messaging applications for vocabulary learning

and pushed output contribute to the present study's investigation. Additionally, the current paper proposes that further research is warranted to enhance our knowledge base of instant messaging apps as valuable tools for teaching EFL. Pushed-output is justified since EFL classrooms are adopting instructional techniques that emphasise activities, interaction, and output. This supports [Long's \(1996\)](#) interaction theory, which contends that face-to-face contact supports L2 acquisition ([Van Patten and Williams, 2014](#)). Although interaction is not the focus of the present study (technology is), nevertheless, interactive components may influence psycholinguistic responses and the processing of novel language-related tasks and items. The subject of this study is how these techniques can be supplemented by pushed-output using digital platforms outside the classroom. This has significant implications for teaching practice. Testing, understanding, and production affect learning and vocabulary usage.

The substantial contribution of the digital transformation to the objectives of the Saudi Vision 2030 framework has been underscored by recent research ([Hassounah et al., 2020](#)). In Saudi Arabia, educational technology is being given a renewed priority as a means of improving the cognitive and communicative abilities of university students, thereby contributing to the nation's educational advancement objectives ([Singh and Alhabbas, 2024](#)).

In addition, research has investigated the benefits and obstacles of Smart Learning environments in Saudi Arabian higher education institutions ([Fayez et al., 2021](#)). The educational sector has been provided with insights into the potential benefits and obstacles of integrating such technologies. Furthermore, the exploration of a digitally secured model for the educational sector in Saudi Arabia, which is based on blockchain technology, has underscored the significance of digital transformation in the improvement of educational practices ([Alangari et al., 2022](#)). These studies emphasise the ongoing endeavours to modernise education through innovative technological solutions, which are consistent with the objectives of Saudi Arabia's Vision 2030 to promote sustainable development and a knowledge-based economy. The research conducted in Saudi Arabia illustrates a concentrated effort to utilise technology to improve educational practices and correlate with the nation's strategic vision for the future.

2.1 The testing effect

On the testing effect, multiple studies ([Carrier and Pashler, 1992](#); [Roediger and Marsh, 2005](#)) have recommended that students complete a delayed test using the same cues and utterances after studying multiple materials and taking a pre-test. This strategy has been shown to improve target language retention in intervals if the recovered material is remembered well ([Roediger et al., 2011](#); [Keresztes, 2013](#)). However, the extent to which this memorial advantage applies to non-restored test content as well as signals is important.

Previous research ([Roediger and Karpicke, 2006a,b](#); [Roediger et al., 2011](#)) has shown that vocabulary retention from testing goes beyond initial test material. Some research ([Chan et al., 2006](#); [Chan, 2009](#)) has shown that testing affects knowledge that is not being directly tested yet which is somehow *connected* to what is being tested. Other research has reinforced the transferability of testing information. [Rohrer et al. \(2010\)](#) claimed this knowledge might be used to clearly answer diverse questions, while [Butler \(2010\)](#) noted

that it can transfer questions in different contextual domains and with different responses.

Barnett and Ceci (2002) and Butler (2010) found that studying helps the learner remember non-tested cues from research materials. Additionally, McKenzie (1972) advocated for the transmission of cues. However, findings from Carrier and Pashler (1992) and Roediger and Marsh (2005) suggest that mnemonic testing facilitation is inaccurate, especially when recovered cues are assessed under comparable settings as the first test. To improve cue retention, it is possible to develop an initial test that strengthens the association between the target and the cue by utilising the target as a prompt. Notably, some research has shown that testing improves cue retention (McDaniel et al., 2007).

However, the testing effect shows that appropriate feedback and testing during learning promotes long-term information retention (Roediger and Karpicke, 2006a,b). Due to the testing techniques used, it is crucial to maintain the vocabulary learnt throughout the intervention and, in the present study at least, to compare email and non-digital output results. According to the 'levels of processing' theory (Craik and Lockhart, 1972), learners are more likely to remember an item if they are cognitively concerned with it (the three groups in this study will be taught this idea). The subject of how productive activities assist learners acquire vocabulary is vital yet understudied (Nation and Webb, 2011), and the literature has paid little attention to pushed output vocabulary learning activities (Nation and Webb, 2011), which is surprising given that they encourage vocabulary use, help learners comprehend unfamiliar terms, and reinforce partially understood terms through productive application.

2.2 Email in pushed-output pedagogy

Swain (1985, 1993) stated that effective pushed output needs continual practice as it allows time to reflect, detect flaws, and rectify errors based on past input and understanding. By presenting instructions and generating subsequent texts using target words through the use of CALL technologies, which are then returned via email, it is possible to review, reevaluate (identify errors), and amend (correct) the initial messages within minutes. In order to ensure accurate output, respondents can utilise the technology to request clarification without requiring the originator to resume the cycle of reflection, identification, and correction. These classroom activities may be extended to outdoor learning. Yao (2011) argued that while privacy, appropriateness, and material management can be monitored internally, such oversight is not applicable externally. In other words, when students engage with technology outside the classroom, they encounter different dynamics. It is intriguing that Yao (2011) and Lauricella and Kay (2013) found that students were more motivated to utilise email outside of class than *in* class. Even with the lack of control and privacy/content problems, technology outside the classroom improves learning.

Some studies have used messaging apps to explore the use of CALL technology as a resource for teaching and learning EFL. Han and Keskin (2016) examined how WhatsApp in undergraduate L2 speaking lessons affected speaking anxiety. A total of 39 participants completed WhatsApp exercises in L2 speaking lessons over four weeks. Face-to-face interviews examined their perceptions of the exercises. The results showed that WhatsApp workouts reduced L2 speaking stress and anxiety, improving language acquisition.

Alahmadi et al.'s (2023) study of the teaching of vocabulary using technology in and out of class found that WhatsApp outside the classroom had a tiny but considerable impact on the learning of vocabulary, while within the classroom it did not. The research also found that students liked using WhatsApp to acquire language, particularly for teacher availability, and that students who were more driven to utilise WhatsApp in class learned more.

In their mixed-methods investigation, Cetinkaya and Sütücü (2018) examined the impact of WhatsApp and Facebook on the acquisition of English vocabulary. The learners' pre-and post-test scores varied significantly across three groups: WhatsApp, Facebook, and control. WhatsApp had the greatest score improvement. The performance of Facebook surpassed that of the control group. In conclusion, this type of technology could potentially enhance the acquisition of vocabulary.

If we compare the use of messaging apps with email, WhatsApp, as an example of the former, allows messages to be examined, re-considered, and altered quickly (reflection, mistake detection, and correction). It is also possible to seek clarification without correction. WhatsApp and related technologies are more synchronous and shorter than emails since their language is quicker and more casual (Allagui, 2014). However, despite these benefits of using Whatsapp, email was still deemed the optimum medium for the present work because students may log in and react at their convenience. In addition, email can store and replay the communication and is more professional than other digital media (Gonglewski et al., 2001). This formal element makes email better for judging pushed output. Students connect WhatsApp and other instant messaging programmes with casual, social engagement (hence the acceptable use of emoticons in Whatsapp messages), whereas email is considered more formal and thus requires precise English use (Chalak et al., 2010). Thus, supporting this medium assures that students stay focused and learning-centred, unlike WhatsApp or other IM apps.

According to So (2016), in order for CALL initiatives to be successful, whether implemented independently or in conjunction with a technology-enhanced learning process, it is imperative to take into account the technological proficiency of the students. To give students time to acclimatise to the new learning method, material should be presented piecemeal (Stahl et al., 2010). This demonstrates another virtue of email, as one example of CALL: it can be brief and informative. Traxler (2009) noted that learners learn at various speeds and employ different tactics. Utilising a tiny, bite-sized approach allows students to become acclimatised to utilising technology in and out of the classroom (Şahin Kızıl, 2017).

Email technology enables students to employ language in their communications outside of class, improving writing and increasing production. As Bouhnik and Deshen (2014) noted, most interactive call systems allow writing, which integrates all language abilities and supports metacognitive language development. The autocorrect mechanism on most email clients helps with spelling as well as vocabulary (Allagui, 2014). Based on Laurillard's conversational framework, email in the classroom should support and reinforce learning rather than replace it, building on conventional methods to enhance collaboration, discussion, production, and articulation. Email, as noted by Laurillard (2010), can reduce the speaking anxiety of reticent students and encourage their participation in classroom activities and discussions, thereby highlighting its value as part of a technology-enhanced learning focus, even when used in the

classroom. It is imperative to contemplate boosting output once the utility of technology in vocabulary acquisition has been established.

Mental lexicons (repositories of words) are researched for their function in language acquisition. Language use involves mental storage of words, associations, and meanings for particular lexical elements (Richards and Schmidt, 2002). The mental lexicon is to determine how email improves memory and recall of vocabulary based on a mental lexicon's identification of brain mechanisms for language processing and representation.

This approach supports Ellis and He's (1999) results in their study of technology's deeper processing and Gass's (1988) psycholinguistic notion of phases in language acquisition. In consequence, emailing replies may urge students to explore their mental lexicon in order to generate accurate language output or to revise initial responses when responding via email.

3 The current study

Concerning how the use of email activities performed in or out of the classroom (Bollen et al., 2012; East and King, 2012) and the learning environment (Grgurovic, 2011) to facilitate vocabulary acquisition, the present study addresses a global gap in the literature. This perhaps somewhat surprising given that the COVID-19 epidemic forced instruction online via email and applications such as Zoom across the world, adding a new impetus to the need for research on EAL utilising new technology. The current study thus targets adult English majors looking to write and combine vocabulary using pushed output and email.

Although separate studies have been conducted on email, email and language, and pushed output (Alsaleem, 2013; Razak et al., 2013; Allagui, 2014; Albaqami and Alzahrani, 2022), only one study has investigated the relationship between email and pushed output and the acquisition of vocabulary among university undergraduates (De la Fuente, 2003). This study centred on Spanish learners acquiring noun meanings, in contrast to the current study's investigation of EFL learners constructing narratives through the use of abstract nouns and verbs. In the UK, just one paper (Arnot et al., 2014) has addressed the matter. The focus of Arnot et al.'s (2014) paper was school-based EAL pedagogy and email integration, and there was no explicit emphasis on pushed output learning.

In Saudi Arabia, there is a paucity in research on email and ESL pedagogy. A single study to date, by Al-Ahdal and Alharbi (2021), is pertinent. Their research centred on collaborative endeavours conducted in groups rather than individual ones, which sets it apart from the current research. In addition, their research exclusively examined the short term, specifically from pre-testing to post-testing and from pre-testing to delayed post-testing, whereas the current research investigates both the short and long terms. The current paper will thus address certain literature gaps and several concerns that have received little attention, making it novel in its use of pushed output and email to develop course materials and measure vocabulary using productive knowledge and vocabulary knowledge scales (VKS) tests for verbs and abstract nouns over the long and short terms.

Following on from noting the surprising gap in the global literature on the subject, the current research has three objectives:

- To evaluate the immediate and long-term effects of pushed output on adult Saudi EFL learners' English vocabulary learning.

- To assess the impact of pushed email on language learning in the short and long terms.
- To compare the short-term and long-term impacts of email and pushed output on EFL Saudi students' English vocabulary acquisition.

The results of this research support the use of educational email to teach English verbs and abstract nouns for writing. The results demonstrate how email + pushed output in EFL courses might improve learning in Saudi universities. Other aims include comparing learners' vocabulary sizes in pushed email classes, non-pushed classes and pushed classes and assessing lexical selections and forms over a period of time. Many studies have focused on non-English majors, but few have focused on English majors, making this a fresh and promising field for study.

The study will seek answers to the following main question:

RQ1. Do differences in vocabulary usage emerge when students participate in a pushed output class as opposed to a non-pushed output class over the short and long terms?

In the course of answering this question, two sub-questions will be addressed:

RQ1a. Does short-and long-term involvement in a pushed output class with email vary from a class without email for enhancing students' vocabulary skills?

RQ1b. Do email and pushed output improve students' vocabularies over time?

4 Methodology

4.1 Participants

In the first semester of the 2019–2020 academic year (September to late November), three groups of adult female Saudi EFL students aged 20–24 were recruited from three English majors courses in the third year at Qilwah College of Arts and Sciences, Albaha University, Saudi Arabia.

4.2 Dependent and independent variables

The pushed class condition, non-pushed class condition and pushed email condition are independent variables. The dependent variables in this study are the gain scores from the pre-test to the post-test and the gain scores from the pre-test to the delayed post-test. Productive knowledge was assessed through sentence completion, and vocabulary knowledge was evaluated using the VKS, which represents receptive knowledge.

4.3 Tests and materials

Testing the participants' goal item knowledge is crucial (Nation and Webb, 2011). The pre-tests comprised a VKS productive and

receptive knowledge examination (detailed below). The researcher prepared the pre-testing, post-testing, and delayed testing questions based on the lexical items of 10 units from the 30 units of the coursebook. The three groups were taught 90 target words progressively over five weeks—18 words weekly and six words every session.

The assessments used abstract nouns and verbs depending on the students' third-year language skills. Verbs help finish sentences, according to [Tomasello \(1992\)](#). They are especially important for language acquisition because they help learners form sentences; every phrase needs a verb, and the verb is frequently what defines that phrase. Abstract nouns, which are also required for sentences, are learned in conjunction with verbs, according to [Bird et al. \(2001\)](#), due to the conceptual nature of the former and the tangibility of the latter. These two aspects of language will thus be used in the research.

The points above support [Skinner and Wellborn \(2019\)](#) and [Lopez \(2020\)](#), who stressed the relevance of spoken instruction or distinct delivery of instructions in pushing output. Some languages share root words or sounds for the same term in their verb conjugation and noun use. Language learners may be able to determine whether a verb or noun word needs to be altered in order to make sense by listening to a phrase in one language and a verb in their own. Although pushed output parameters have been shown to be more beneficial for learning a language, much remains to be learned about their proper implementation. Students may better address their language learning strengths and shortcomings by encouraging output, autonomous learning, and critical thinking ([Wei, 2018](#)). The contention is that if Saudi students were encouraged to read and write letters, write tales, or talk, they could learn better by being able to integrate comments into future responses.

The students' instructor gave classes to three groups. Three groups were selected since the English School at Qilwah College of Arts and Sciences at Albaha University has three trimesters. Before beginning the treatment, the students in the three groups completed a pre-test to ascertain their target vocabulary level. Following the treatment, they completed a post-test to compare their achievements across the three

conditions. Finally, they underwent a delayed test to assess their retention of lexical knowledge. Five weeks separated each test to limit the influence of the three conditions on the treatment's results.

4.4 Test of productive knowledge

Productive knowledge was tested using [Laufer and Nation's \(1999\)](#) production test. Five frequency levels and completion items, such as "the garden was brimming with fra_____ flowers," were utilised in conjunction with controlled production to quantify productive vocabulary. This technique may be connected with the VKS to detect pre-post and delayed gaps in students' comprehension and production of vocabulary to determine whether email intervention might help.

4.5 Vocabulary knowledge scale (VKS)

The [Wesche and Paribakht \(1996\)](#) VKS test was used to measure the learners' vocabulary strength, size, and depth on a four-point scale. The participants' context-based vocabulary recognition, usage, and comprehension were tested.

Text comprehension, recognition of multiple-choice questions, matching definitions, and sentence completion comprised the examination. The findings include information on the number of terms from vocabulary that are recognised, the frequency with which they are employed, and the extent to which the meanings of the words are understood.

Being self-reported, the VKS test may measure small gains in vocabulary, particularly written vocabulary. It acknowledges that language usage is progressive and diverse. Recognition memory, or passive vocabulary, indicates lexical competency. The VKS test accurately measures vocabulary progress since it analyses incomplete lexical knowledge. [Table 1](#) shows the levels of knowledge assessed with respect to the target words.

4.6 Data elicitation tool administration

Three methods were utilised to teach vocabulary to the students, one for each group. In five weeks, 90 target words were taught (see [Table 2](#)). Six of these words were taught per treatment, or 18 per week, across the three treatment groups. For evaluation purposes, the researcher employed lexical items extracted from '4,000 Essential English Words' ([Nation, 2009](#)).

The target vocabulary comprised 90 words split into three sets of 30 words for each group. The words were counterbalanced to prevent ordering effects. A set was utilised by each group for the pushed class,

TABLE 1 Vocabulary knowledge scale.

1	I do not know what this word means
2	I have seen this word before, but I cannot remember it.
3	I know this word. It means ... (Synonyms or translation)
4	I can use this word in a sentence. (Write a sentence)

Source: [Wesche and Paribakht \(1996\)](#).

TABLE 2 Teaching intervention stages.

Group	Weekly Word Set 1 (6 lexical items)	Weekly Word Set 2 (6 lexical items)	Weekly Word Set 3 (6 lexical items)
1	Pushed class condition	Non-pushed class condition	Pushed email condition
2	Pushed email condition	Pushed class condition	Non-pushed class condition
3	Non-pushed class condition	Pushed email condition	Pushed class condition

the pushed email class, and the non-pushed class. The initial six words from each collection were utilised in Week 1. Group 1's pushed class, non-pushed class, and pushed email conditions received sets 1, 2, and 3. Group 2's pushed email condition received Setting 1, the pushed class condition received Setting 2, and the non-pushed class condition received Setting 3. Set 1 was for non-pushed classes, set 2 for pushed emails, and set 3 for pushed classes in Group 3.

Counterbalancing eliminated ordering effects by randomly assigning order to each condition across the groups. A comparison was made between standard teaching approaches, classroom learning with pushed output, and email learning using three groups and a total of three sets of target words. Each set had 30 words.

The participants were informed of the experiment's goal and methods in the first week. The selected book focuses on graded tales, unlike traditional vocabulary books that organise units by subject (e.g., sports, cookery, transport, etc.). Language acquisition often involves stories (Perks and Lauritsen, 2016), and graded readers help L2 learners acquire vocabulary by simplifying the language (Nation and Meara, 2010). The book helps beginners and expert learners develop their vocabulary by teaching useful, high-frequency words. It has six series with unique terms that cover a large amount of written and spoken language.

Following on from the above, the study included narrative activities. Writing and speaking are language skills, and storytelling helps students to learn how to write and speak. This method makes the activity more relevant by having students tell stories using the target words. The book was thus deemed appropriate for the study. The participants had not encountered the target terms before the experiment and the writing assignment.

4.7 Quantitative data analysis

SPSS was used to test the sample for normal distribution. Two normality tests are Shapiro–Wilk and Kolmogorov–Smirnov. Mishra et al. (2019) recommend the Kolmogorov–Smirnov test for samples above 50, and so, as the present research comprises 54 individuals, this

test was used to investigate whether combining the two advantages would yield a greater benefit after discovering statistical gains in two separate comparisons: a pushed class versus a non-pushed class and pushed email versus a pushed class.

5 Results

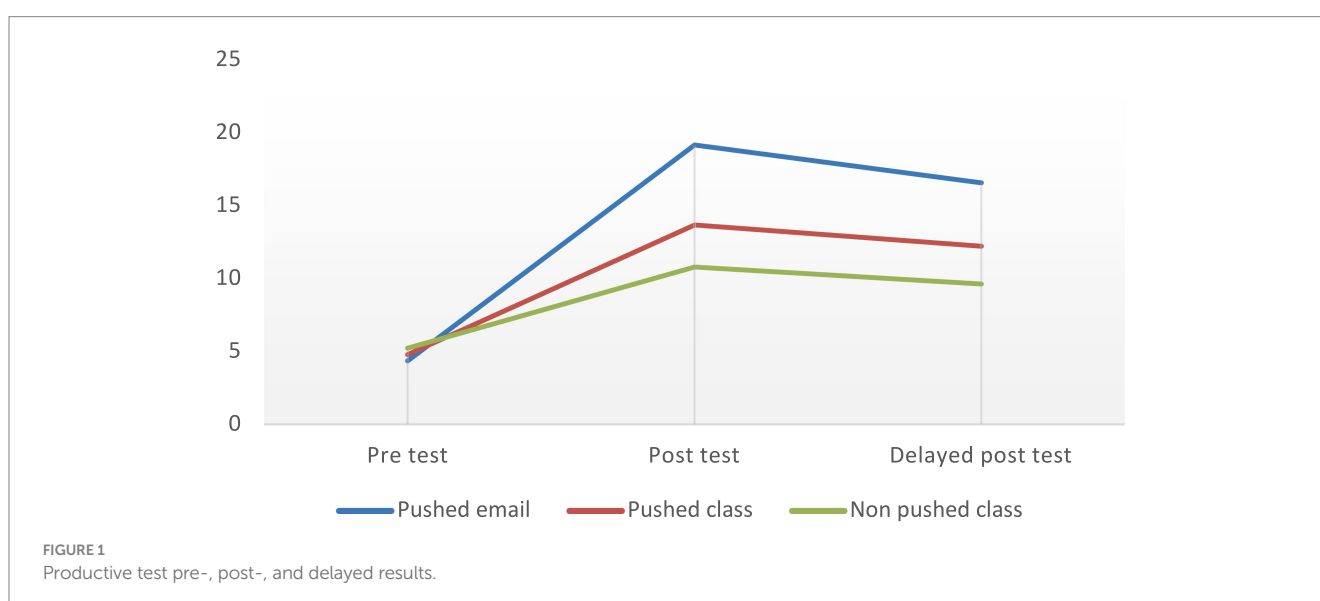
5.1 Productive test data analysis

The main investigation centred on efficacious evaluations across all three conditions (pushed class, pushed email, and non-pushed) prior to, immediately subsequent to, and five weeks after the intervention. According to Figure 1, which shows the average values obtained for each condition at each time point, the average pre-test scores were low in all three scenarios (4.33, 4.76, and 5.2 out of 30), indicating a lack of familiarity with the lexical items on the productive test. No differences were statistically significant between the conditions. The ratings on the post-test were higher in comparison to the pre-test ratings, whereas the ratings on the delayed post-test declined but still indicated progress.

As shown in Figure 1, the post-test performance improved for all three interventions; however, the pushed email condition demonstrated a greater improvement than the other two conditions. That is to say, the students who received pushed email learned more. The delayed post-test scores declined but improved on the pre-test levels, especially in the pushed email condition.

A Kruskal–Wallis test was performed to determine whether the three conditions differed significantly. Pre-test scores for the three conditions did not differ significantly (Kruskal–Wallis=3.397, $p=0.183$, $df=2$), indicating that all three conditions had a p -value of less than 0.05.

Table 3 has six columns: Conditions, Pre-test, Post-test, Delayed post-test, Pre-test to Post-test gain scores, and Pre-test to Delayed post-test gain scores. The rows represent several instructional strategies: Pushed class condition, pushed email condition and non-pushed class condition. The Pre-test column displays student mean scores before intervention-based assessments. Students' average test results after using instructional techniques are shown in the



Post-test column. The Delayed post-test column provides the mean scores of learners who were reviewed later. Student performance improved, as evidenced by gain scores from Pre-testing to Post-testing and gain scores from Delayed post-testing.

Table 3 shows that all three teaching methods improved the students' pre-test, post-test, and delayed post-test results. Importantly, the pushed email students scored higher on both exams than the other students. These findings thus suggest that pushed email instruction may improve student performance.

5.2 Productive test effect size

Table 4 shows that pushed email had the highest short-and long-term influence on gain scores. From pre-testing to post-testing, the score was 0.26, a significant score (Cohen et al., 2013). Additionally, the short time frame between the pre-and post-test demonstrated that the effect size of the pushed email class was greater than that of the pushed class. As a result, the impact size was greater for students who completed their exercises via email outside class while utilising pushed

output. The impact size of the pushed email class was greater than that of the pushed class from pre-test to delayed post-test (0.20 vs. 0.18). Although both impacts were of a moderate magnitude, the pushed email class received a score of 0.20, as opposed to 0.18 for the pushed class. The impact magnitude was greater for students who completed their assignments through distributed output and email outside of class than for those who did so during class.

5.3 A VKS test analysis

A Kolmogorov–Smirnov test was used to check whether the pre-tests, post-tests, and delayed post-tests were normally distributed before examining the research questions. In the test, non-parametric tests were chosen.

Analysing the VKS test began by coding the pre-test, post-test, and delayed post-test for these three circumstances. Analysis was done by coding the pre-test, post-test, and delayed post-test scores for each condition. For each condition across three time periods, statistics of mean values are displayed descriptively in Figure 2.

TABLE 3 Comparison of the productive test performance of students under the three conditions.

Conditions	Pre-test	Post-test	Delayed post-test	Gain scores from pre- to post-test	Gain scores from pre-test to delayed post-test
Pushed class	4.76	13.61	12.15	8.80	7.44
Pushed email	4.33	19.07	16.48	14.74	12.13
Non-pushed class	5.2	10.74	9.59	5.50	4.39

TABLE 4 Productive test effect size.

Comparison	Pushed email versus pushed class	Pushed class versus non-pushed class
Pre-test to post-test	Effect size: 0.26 (large)	Effect size: 0.19 (medium)
Pre-test to delayed post-test	Effect size: 0.20 (medium)	Effect size: 0.18 (medium)

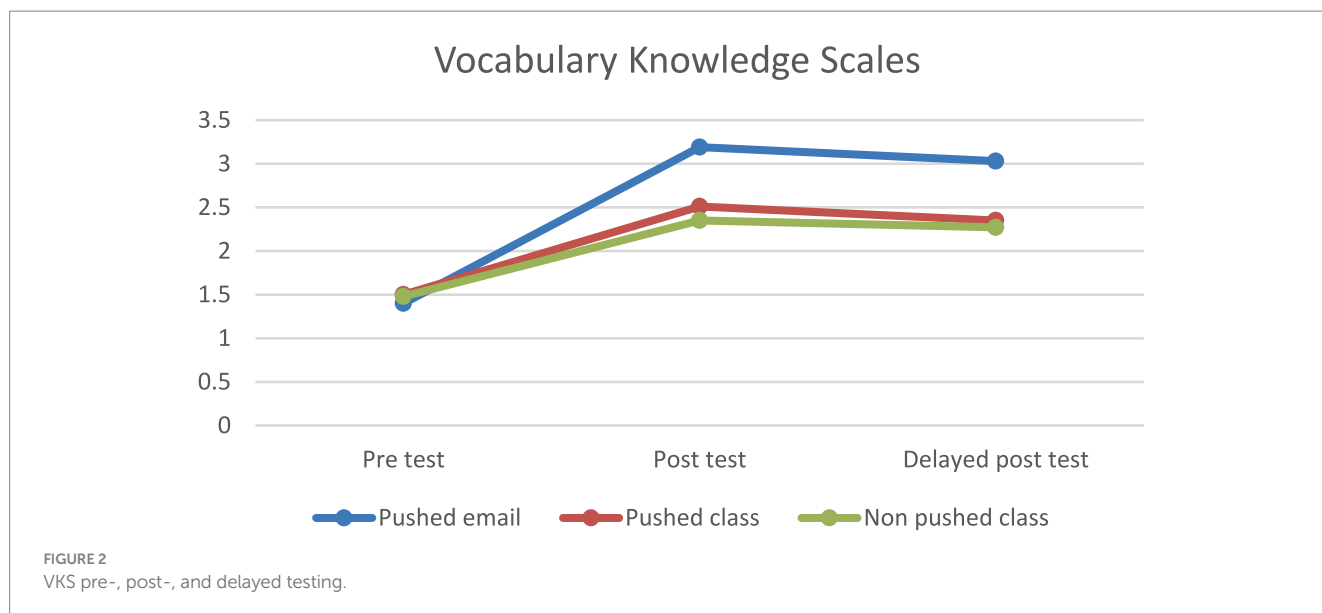


Figure 2 shows descriptive data, with a line for each condition's mean scores at each of the three time periods. The mean pre-test scores for the three situations (1.4, 1.5, and 1.48 from 4) were low. This suggests that the students lacked familiarity with the vocabulary of the VKS test. Additionally, the findings showed no significant differences amongst the students. The three conditions' post-test scores improved considerably vis-a-vis the pre-test scores, even if the delayed scores declined.

Figure 2 shows that post-test scores rose for all three situations, but the pushed email condition increased more than the pushed class and non-pushed class conditions, meaning that student learning was enhanced in the pushed email condition. Although the delayed post-test scores experienced a decline, they still exhibited an improvement over pre-test levels. Notably, the pushed email condition demonstrated the most substantial increase vis-a-vis the other two conditions.

Using the Kruskal–Wallis test, a non-parametric method for comparing continuous variable outcomes (VKS pre-test scores), it was possible to determine whether or not the three conditions of each student differed significantly. As the primary non-parametric test for comparing three variables, this test was employed, and the levels of the students prior to treatment were ascertained through the pre-tests.

The Kruskal–Wallis test yielded insignificant differences among the three conditions ($df=2$, Kruskal–Wallis = 5.451, $p=0.065$), suggesting that all p values exceeded the threshold of 0.05.

Table 5 compares the teaching efficiency of three educational methods. The six columns in the table are: Conditions and Gain scores from pre-test to post-test and delayed post-test. The first column shows the Pushed email condition, the Pushed class condition and the Non-pushed class condition. The subsequent three columns display the mean results of each group prior to the treatment, immediately following the treatment, and in the delayed post-test. The final two columns show each group's pre-test to post-test and delayed post-test gain scores. The pre-test scores were subtracted from the post-test and the delayed post-test scores in order to determine the gain score.

From pre-test to post-test and delayed post-test, all three instructional strategies improved student performance (see Table 5). The pushed email condition excelled in both tests. Pushed email had an average gain score of 1.79 from pre-test to post-test and 1.63 from delayed post-test. This implies that pushed email may boost student performance.

TABLE 5 Student VKS test performance under the three conditions.

Conditions	Pre-test	Post-test	Delayed post-test	Gain scores from pre-test to post-test	Gain scores from pre-test to delayed post-test
Pushed email	1.4	3.19	3.03	1.79	1.63
Pushed class	1.5	2.51	2.35	1.00	0.89
Non-pushed class	1.48	2.35	2.27	0.87	0.77

TABLE 6 VKS test effect size.

Comparison	Pushed email versus pushed class	Pushed class versus non-pushed class
Pre-test to post-test	Effect size: 0.73 (large)	Effect size: 0.10 (medium)
Pre-test to delayed post-test	Effect size: 0.72 (large)	Effect size: 0.10 (medium)

5.4 The VKS test effect size

The greatest short- and long-term gains were observed in the case of pushed email as opposed to the pushed class case from pre-test to post-test (see Table 6), with a score of 0.73, which Cohen (2013) considered substantial. The results from the short term (pre-test to post-test) indicated that pushed email had a significant impact in comparison to the moderate effect size observed in the pushed class. This suggests that students who participated in the activity through email outside class using pushed output experienced a greater effect size than those who did so in class. In the long run, from pre-test to delayed post-test, pushed email had a larger impact than the pushed class (0.72 vs. 0.10). The students whose promoted output activities were completed via email outside of class had a greater impact than those whose activities which were completed in class.

6 Discussion

6.1 Learning vocabulary with pushed output

To reiterate, the main research question was: Do differences in vocabulary usage emerge when students participate in a pushed output class as opposed to a non-pushed output class over the short and long terms?

To answer this, productive and VKS tests were done. Short-and long-term analyses utilised gain scores from the pre-test to the post-test, as well as the delayed post-test. On both the productive and VKS exams, the pushed cohort exhibited a superior performance in the short and long terms compared to the non-pushed class.

- The pushed class condition had higher short-term productive test results than the non-pushed class ($r^2=0.19$, $p<0.05$).
- The pushed class had greater long-term productivity results than the non-pushed class ($r^2=0.18$, $p<0.05$).
- Short-term vocabulary scores were higher in the pushed class condition compared to the non-pushed class condition ($r^2=0.10$, $p<0.05$).
- The pushed class had better long-term vocabulary knowledge outcomes than the non-pushed class ($r^2=0.10$, $p<0.05$).

In the long and short terms, students who engaged in activities requiring pushed output acquired vocabulary more effectively than those who did not. Recapping pushed and non-pushed output facilitated task comprehension. Non-pushed output occurred when a student was instructed to produce a statement or response and either received a direct correction, which limited the learner's opportunity for self-reflection and correction, or no correction was made, which excluded the learner from the appropriate production. Pushed output encouraged the students to recognise, reflect on, and fix their mistakes. Given these distinctions, pushed output has a greater potential to develop language abilities by increasing student self-awareness and self-correction.

Pushing output fosters reflection on input since it shows what learners can do when pushed to utilise the target language clearly and properly, according to Ellis (2003). The findings follow shifting communicative techniques and the promise of language pedagogy to improve fluency and accuracy in English language education worldwide. Educational psychologist Lev Vygotsky (1896–1934) established that social contact is crucial to language and cognitive development (Vygotsky, 1978). Vygotsky put social interaction and learning above intellect, making verbal (or written) reflection vital to learning. The results here show that Vygotsky's (1978) social and cultural settings of learning are linked by learner self-awareness and self-correction.

The present research defines pushed output as a situation when, 'pushed' to engage in production and generate correct, appropriate and specific exact replies (Swain, 1985), learners generate suitable and precise responses. These results were found in the present study. In terms of the VKS and productive tests, the results indicated that the pushed class achieved higher scores in both tests vis-à-vis the non-pushed class.

Lopez (2020) examined EFL students at a private Colombian school using current tests similar to what this study has used. Naturally, differing settings and participant groupings restrict cross-group comparisons given that, according to Vygotsky (1978), cognitive development differs between cultures, and hence study methods should vary. A distinction was made between the output and non-output groups by Lopez (2020); the output group engaged in comprehension exercises for five weeks while the non-output group participated in oral pushed output activity. Lopez (2020) found that encouraging meaningful oral delivery improved pupils' oral production. According to Lopez (2020, p. 86), "students perceived oral pushed output as an affectivity regulator in L2 oral production that authorised them to obtain habituated and as a trigger of exposure to L2 vocabulary, grammar, and pronunciation."

One issue with studying English in Saudi Arabia is that the curriculum remains very much instructor-focused. This approach undermines Vygotsky's (1978) interactive, social learning principle as it limits classroom communication, with the centre of action being the instructor rather than the students. In contrast, the pushed output approach encourages students to use words in a tale and get instructor feedback.

On productive vocabulary tests, the present research concurs with the findings of De la Fuente (2002), who discovered in post-tests (short term) that L2 intermediate students who were required to produce output performed better than those who

were only asked to provide input. This research centred on Spanish students learning noun meanings, whereas the present study focused on English learners building stories using abstract nouns and verbs (Pandey, 2015).

Pushing output seems to improve vocabulary acquisition, suggesting a benefit in this technique. Thus, creating a story and receiving instructor comments might help learners acquire English vocabulary. This comparison was made in order to highlight the second distinction between pushed output and technologies such as pushed email, which, as explained below, is the study's primary research deficit.

Additional research supports the notion that pushed output enhances learning; however, this research was focused on reading, speaking, and listening (Hazrat and Hessamy, 2013; Beniss and Bazzaz, 2014; Namaziandost et al., 2019b). In contrast, the current research focuses on writing. Hazrat and Hessamy (2013) discovered that when compared to writing pushed output, intermediate Iranian women L2 learners who studied vocabulary through oral pushed output demonstrated enhanced active lexical item learning and improved listening knowledge.

These results show that pushed output hypothesis-based teaching enhances student performance, supporting the proposed benefits of pushed output. The study postulated that there would be a statistically significant distinction between the pre-and post-test gain scores of pushed and non-pushed class participants. This mixed methods research examined whether Middle Eastern English major students studying vocabulary and writing might learn better in pushed output exercises than in non-pushed output activities. The findings show that pushed output activities can help students learn vocabulary better because writing words in narrative form sustains vocabulary practice and English thinking. This finding corroborates the assertion made by Roediger and Karpicke (2006a,b) that the efficacy of feedback and assessment during the learning process enhances long-term information retention, as this held true for both the short and long terms. The present study's delayed post-test for vocabulary retention showed that pushed output students performed better than non-pushed output students.

Hulstijn and Laufer (2001) and Nation and Webb (2011) similarly discovered challenges in long-term learning with long-term memory from pre-test to delayed post-test for the VKS and productive assessments. Meeting educational requirements, encountering new knowledge, and recognising relevant possibilities may help language students use their vocabulary. In the current research, long-term language retention was hypothesised to be more effective for those students who engaged in activities in a pushed class compared to those who participated in exercises in a non-pushed class. As indicated by the outcomes, students in the pushed class performed better than those in the non-pushed class. Consequently, both immediate and delayed post-testing demonstrated the utility of pushed output strategies.

Several studies evaluated in this paper have found that pushed-output improves vocabulary acquisition. While previous research has concentrated on increasing output in learning vocabulary, the current study's mixed methods investigation addresses this gap in the literature by examining intermediate-level English major students in the short and long terms.

6.2 Learning vocabulary with technology

This section explores the productive and VKS test findings to answer RQ1a, which was devised to explore the impact of pushed email on language acquisition based on the short- and long-term gain scores for the pre- and post-tests.

This section examines the second comparison, namely, a pushed output class without email versus a pushed email class.

Productive and VKS tests were used initially. Short-term and long-term gain scores were utilised from the pre-test to the post-test and the delayed post-test, respectively. The pushed email condition outperformed the pushed class in the productive and VKS in both the short and long terms.

- The pushed email condition resulted in higher short-term test results compared to the pushed class ($r^2=0.26, p<0.05$).
- Long-term productivity was greater in pushed email compared to pushed classes ($r^2=0.20, p<0.05$).
- Short-term vocabulary scores were significantly higher in the pushed email compared to the pushed class ($r^2=0.73, p<0.05$).
- Pushed email resulted in stronger long-term vocabulary knowledge than the pushed class ($r^2=0.72, p<0.05$).

Students who engaged in activities through pushed email demonstrated superior learning of vocabulary in both the short and long terms compared to those who completed activities in a pushed class without email. The second comparison (context) between the pushed email class and the pushed output class, assessed by the productive test, revealed that the former produced greater short-term (pre-testing to post-testing) and long-term (pre-testing to delayed post-testing) gain scores.

Upon conducting the VKS test, focusing specifically on the second comparison (context) between pushed email and pushed output, it was observed that the pushed email condition exhibited superior short-term and long-term gain scores compared to the pushed class condition.

According to the literature, numerous studies have examined the pedagogical use of technology for vocabulary development. The present study agrees with this body of research in that technology helps learners acquire vocabulary by exposing them to spaced repetition, which is more effective than high repetition.

Song and Fox (2008) discovered that using SMS and the internet to acquire language boosted vocabulary. Later research by Hsu (2015) verified these results. The current research supports these findings by showing that learners who conducted vocabulary activities via pushed email learned more than those who did them in a pushed class without email. Whether technology is used in or out of the classroom, Cavus and Ibrahim (2009), Basoglu and Akdemir (2010), and Stockwell and Liu (2015) all identified positive effects on vocabulary knowledge. Particularly among students who were previously unmotivated to engage in independent, self-regulated learning, email may increase student productivity (Zhang et al., 2011). Put simply, students' learning experiences are improved through interaction with online learning.

Adopting a mixed methods approach, the present study addressed a contextual gap in research in Saudi Arabia concerning technology and ESL pedagogy by comparing the short-term and long-term impacts of technology on the learning of English vocabulary among

intermediate-level English majors' students at a Saudi university. The study also sought to address a Covid-19-related gap in the literature. Just as ESL has expanded in UK schools and language centres owing to the significant number of L2 learners from Eastern Europe, Iraq, and Afghanistan entering the country after Brexit, the COVID-19 epidemic forced online instruction via such technologies as email and Zoom. Thus, research on technology and EAL pedagogy became important internationally.

Some US and Latin American studies (Lopez, 2020) exist, but UK studies are lacking. Only a Refugee Council-commissioned study by Arnot et al. (2014) has examined this topic. Although it used technology in teaching, the research focused on in-school EAL pedagogy, not forced learning. Al-Ahdal and Alharbi (2021) is the only Saudi study with identical data collecting. Their study concentrated on group cooperation instead of solo tasks, which is the focus of the present research. Moreover, Al-Ahdal and Alharbi (2021) only examined pre- and post-testing over the short term. The present research concurs with Al-Ahdal and Alharbi's (2021) three-month study, which developed critical knowledge applications for 80 mixed-gender English students at two Saudi institutions. Their mixed methods research improved vocabulary memory in pre- and post-test results for both genders.

The current study discovered that learners who completed activities via pushed email had superior long-term and short-term memory (gain scores from pre-test to post-test) in two contexts—pushed email versus pushed class—as measured by a productive and a VKS test. This implies that the learners maintained their vocabulary from the post-test to the delayed post-test, as the difference was only 0.01. The short-term productive test scores were higher than the long-term scores for those students who did exercises via pushed email. Despite the fact that short-term scores were greater than long-term scores (0.26 vs. 0.20), the effect magnitude for both was still substantial. According to the current research, then, students may preserve their English vocabulary longer while utilising technology, with a substantial long-term impact size.

Language help during integration may speed up cognitive processes needed for correct output. In addition to other factors, the asynchronous and unstructured nature of the platforms may enable technology to facilitate this process. This section provides confirmation that the participants of the present study gained significantly more knowledge from pushed email (technology) than from a pushed class with no technology. Thus, CALL and its role in pushed output must be considered as an asset in language learning and teaching.

6.3 Vocabulary learning with pushed output and technology

This section provides a summary of the results obtained from the productive and VKS tests in relation to RQ1b, which examined email support and enhancement of pushed output. RQ1b was devised to explore how email with pushed output supports the learning of vocabulary by measuring its impact on language learning using short-term and long-term gain scores. This question was not easy to measure, but the effect size utilised to calculate the results analysis of RQ1 and RQ1a (to evaluate whether pushed output and email have bigger-than-expected impacts) was used to answer RQ1b.

To recap RQ1b: Do email and pushed output improve students' vocabulary over time?

In order to examine RQ1b, the previous two sections conducted comparisons between a pushed class and a non-pushed class, as well as between pushed email and a pushed class. The impact size calculation indicated a statistical advantage between the two comparisons (pushed class versus non-pushed class and pushed email versus a pushed class), as hypothesised. Additionally, whether email and pushed output might offer any further benefits compared to traditional classroom methods was also investigated. Following the validation of the hypotheses in the aforementioned two comparisons, the effect size was employed to assess whether the magnitude of the impact of pushed email was greater than that of the pushed class, thereby providing an answer to RQ1b.

The study found that the pushed email class had the biggest impact size on short-and long-term gain scores. In the short term (from pre-test to post-test), the effect size of the pushed email class was higher than that of the pushed class. The impact was significantly higher for students who completed their exercises via email outside class using pushed output, as opposed to those who completed them in class. Over time, the pushed email class exhibited a larger impact size than the pushed class, spanning from pre-testing to delayed post-testing. While both classes experienced medium-sized effects, the pushed class achieved a score of 0.20, while the pushed class scored 0.18.

SPSS analysis of the VKS test, specifically the effect size of the two comparisons, revealed that the pushed email condition exhibited superior short-and long-term gain scores vis-a-vis the pushed class condition.

Pushed email had a more noticeable short-term impact (from pre-test to post-test) than the pushed class. This suggests that students who utilised pushed output to participate in email activities outside of class had a more substantial effect size.

Compared to the pushed class, pushed email had a larger size influence from pre-test to delayed post-test. The impact magnitude was greater for students who completed their assignments via email outside of class using pushed output, as opposed to those who did so in class. The literature review observed that [De la Fuente \(2003\)](#) validated pushed output in a study of English-language speakers studying basic Spanish in a complete second semester session. However, Computer-Mediated Communication (Virtual Chat on Blackboard) mediated engagement seemed to be less beneficial for strengthening L2 speaking abilities, especially vocabulary productivity. On productive vocabulary examinations, students who were required to produce output performed better than those who were only required to provide input, according to [De la Fuente \(2003\)](#). She indicated that, as a result of more intensive output processing, these students benefited more from the negotiating strategy that promoted L2 vocabulary development via Computer-Mediated Communication and synchronised interactive tasks. The present study focused on learners of English, whereas [De la Fuente \(2003\)](#) researched learners of Spanish. The present research exclusively examined student-teacher interactions, unlike [De la Fuente's \(2003\)](#) research on student-student interactions.

Numerous studies have examined the effects of technology-enhanced digital activities inside and outside the classroom and learning environment on vocabulary development, according to the literature review. [Alsalem \(2013\)](#) studied how WhatsApp assisted Saudi Arabian students to use vocabulary in their writing. Her findings showed that,

since the pre-test and post-test scores differed significantly, technology does aid students' acquisition of vocabulary in writing. While there are some similarities between the present study and [Alsalem's \(2013\)](#) research, the former focused on adult learners and addressed a specific need by integrating vocabulary and pushed output through email. The participants in the current study improved their vocabulary through the use of email and demonstrated greater proficiency in productive and VKS assessments in the short term. In addition, in contrast to [Alsalem's \(2013\)](#) research, the current research investigated the long term and found that pupils who engaged in pushed output activities through email performed better than those who did not utilise technology.

[De la Fuente \(2003\)](#) found that Virtual Chat in Blackboard may deepen processing throughout mental lexicon phases. The idea is that emailing replies may help students utilise their mental lexicon (word and usage storage) to produce proper language or reflect and revise initial responses. In this research, the long-term pushed email condition had a VKS test impact of 0.73, compared to the short-term condition's 0.72.

Multiple studies (e.g., [Roediger and Marsh, 2005](#)) have examined the testing effect. In these investigations, the participants were instructed to retrieve identical utterances (targets) after completing a pre-test and a delayed-test containing the initial queries clues. According to a number of studies, this testing methodology improves knowledge retention through the use of intervals, meaning information is more effectively retained.

However, the testing effect shows that effective feedback and testing during learning promote long-term information retention ([Roediger and Karpicke, 2006a,b](#)). In the present research, the students received six items weekly via email or in class and had to write them in narrative form and submit them to their instructor. As in past studies on the testing impact, the participants received feedback over five weeks, a post-test after treatment, and a delayed post-test five weeks later.

Storytelling has several benefits over sentence creation. Discourse knowledge—including narrative elements and motivation—significantly affect story quality, duration, and vocabulary diversity ([Olinghouse and Graham, 2009](#)). This shows that story writing allows for more sophisticated and varied vocabulary than sentence creation. A second study ([Saddler and Graham, 2005](#)) found that instructing students in sentence combination, a common narrative writing technique, enhanced their writing by enabling them to compose more complex sentences.

In addition, tales have been shown to improve vocabulary ([Wilkinson and Houston-Price, 2012](#)). New words are easier to learn and remember when presented in a story. This is particularly true when instructors define new terms and explain them using a dictionary ([Wilkinson and Houston-Price, 2012](#)). Thus, writing tales develops vocabulary and sentence structure.

When contrasting the outcomes of previous studies on the vocabulary of narrative writing, it is critical to note that distinct aspects of writing were the focus. [Olinghouse and Graham's \(2009\)](#) research evaluated how discourse expertise affects story length and language variety. In contrast, [Wilkinson and Houston-Price \(2012\)](#) examined how seeing terms in tales improves vocabulary. Both studies stressed the advantages of story writing, although they concentrated on different writing and language development characteristics.

Finally, story writing has several advantages over sentence creation. It increases discourse knowledge, which improves story quality, length, and vocabulary. Stories boost vocabulary by

introducing terminology. Story writing increases sentence construction and vocabulary development, according to the findings here and in other studies. Including narrative writing in language training may thus help students' overall language development.

7 Conclusion

The purpose of the research was to compare the impact of a pushed email class, a pushed class, and a non-pushed class on the learning of English vocabulary by intermediate Saudi university undergraduates majoring in English. Using mixed methods, the study found that the pushed class conditions resulted in higher productivity and higher VKS test scores in both the short and long terms compared to non-pushed classes, indicating that learners benefited more from exercises with pushed output. The pushed email condition also yielded superior outcomes vis-à-vis the pushed class without email, suggesting that engaging in vocabulary exercises via email was particularly effective. These findings address a gap in research focused on English majors students in Saudi Arabia, contributing to how we understand the effect of technology on ESL education, especially during and since the COVID-19 pandemic, which led to more extensive use of technology in learning. By highlighting effective technology-mediated approaches to vocabulary learning, the study provides valuable insights into curriculum design and instructional practices, ultimately advancing evidence-based teaching strategies in English language education.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

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Ethics statement

The studies involving human participants were reviewed and approved by English Department of Qilwah College of Arts and Sciences, Albaha University, Saudi Arabia. The patients/participants provided their written informed consent to participate in this study.

Author contributions

SA: Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing.

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The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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