

Best Evidence Synthesis of Academic Vocabulary Interventions for Post-secondary English Learners

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Abstract

This research synthesis describes, critiques, and synthesizes intervention studies related to the academic vocabulary acquisition of post-secondary English learners. Using the article matrix and the constant-comparative methods of analysis (Boeije, 2002), this critical synthesis aims to provide a knowledge point on general academic vocabulary; further research on the need for discipline-specific academic vocabulary at the post-secondary level is still needed. Findings regarding best practices include: a) embedded academic vocabulary learning intervention should be integrated with explicit, isolated word learning; b) technology is most effective when combined with other well-established aspects of vocabulary instruction; c) receptive vocabulary gains are highest when pairing the learning and assessment modes (i.e., receptive vs. productive) and pursuing consistency over structure; and d) specific tools base for both researchers and practitioners moving forward. The research focus in the field up-to-this- and materials, such as using a concordance or dictionary, can significantly enhance productive academic vocabulary.

Introduction

The number of international students enrolled in tertiary institutions in the United States have increased tremendously over the past few decades, seeking a variety of degrees. From 2002 to 2009, enrollment of international students in U.S. universities increased by 13%, from 582,996 to 660,581 students (Choudaha & Chang, 2012). As of 2009, the U.S. enrolled about one-fifth of all globally mobile students (i.e., international students or students seeking degrees from a country that was not their country of origin). These numbers continue to increase; from 2013 to 2019, the number of international students in the U.S. rose by 1.3%, from 819,644 to 1,095,229 (Project Atlas, 2020). From 2001 to 2020, the number of globally mobile students more than tripled, from 1.6 million to over 5.6 million; the U.S. continues to be the top receiving country for these students, enrolling 20% in 2020 (Project Atlas, 2020). However, reports from professors (Wang & Bakken, 2004), journal editors (Flowerdew, 2001), and international students themselves (Heng, 2018) indicated the struggles of international students' acquiring and using academic vocabulary as well as needed improvement in their productive academic vocabulary. To support international students' academic vocabulary acquisition, experts have emphasized the need for explicit academic

vocabulary instruction (Gardner & Davies, 2014). Yet, further investigation must be done to identify and evaluate ways to strategically support these students to acquire and become skilled in using academic language.

The Importance of Academic Vocabulary

Vocabulary is undeniably foundational in language learning (e.g., August, Carlo, Dressler, & Snow, 2005; Liu, 2020), regardless of the learners' first language (e.g., Lam, Chen, Geva, Luo, & Li, 2012), age (e.g., Proctor, Silverman, Haring, & Montecillo, 2012), or proficiency level (e.g., Golkar & Yamini, 2007). Researchers continue to confirm the importance of vocabulary for ELs' literacy skills, especially in reading comprehension (e.g., Laufer, 1992; Masrai, 2019; Nation, 2006; Schmitt, Jiang, & Grabe, 2011).

At the heart of academic language is academic vocabulary. Baumann and Graves (2010) note the difficulty in defining "academic vocabulary" as many scholars do not agree upon a consistent definition. Multiple researchers have attempted to further categorize academic vocabulary into subcategories: domain-specific, general, high-frequency, symbolic representations, etc. (Baumann & Graves, 2010; Fisher & Frey, 2008; Harmon, Wood, & Hedrick, 2008). The distinction between general and domain-specific academic vocabulary is important for ELs as it distinguishes words they may encounter across their classes and academic domains (i.e., general academic vocabulary) from words that are specific to certain disciplines (e.g., science or history). In the present study, academic vocabulary refers to the lexis encountered in academic settings having distinctive syntactic, morphological, and stylistic features (Baumann & Graves, 2010; Scott, Nagy & Flinspach, 2008).

Academic Vocabulary for Post-secondary ELs

Self-reports from post-secondary learners reveal that even advanced language users struggle with understanding and using academic vocabulary (e.g., Evans & Green, 2007; Evans & Morrison, 2010; Zhou, 2009). This includes those advanced enough to pass the Test of English as a Foreign Language (TOEFL) and/or Graduate Record Examinations (GRE) that are requirements for colleges and graduate schools in the United States.

Yet academic English is no one's first language; everyone desiring to participate in academic conversations in English must acquire this language—its vocabulary and discourse features. Part of the question here is: do post-secondary ELs have the tools to acquire academic vocabulary successfully? Professors in post-secondary academic settings often spend little time on direct vocabulary instruction, particularly for general academic words. They assume students know these or will figure them out (Santos, 2004) and expect an increased level of literacy.

Our current knowledge level for academic vocabulary at the post-secondary level is sparse but growing. With the current research attention on academic vocabulary, we will continue to grow in our understanding of this field, but we must first pause and reflect on what we have already uncovered so that we can use that knowledge as a foundation on which to move forward.

Gap in the Literature

Researchers have examined various aspects of academic language learning for ELs. Some have explored teacher practices (Keisler & Bowers, 2012), others have investigated socio-cultural and linguistic factors (Lachance, Honigsfeld & Harrell, 2019; Phillips Galloway, McClain & Uccelli, 2020), and many have focused on how K–12 learners acquire academic language and/or academic

vocabulary (e.g., McKeown, Crosson, Artz, Sandora, & Beck, 2013; Taboada & Rutherford, 2011; Townsend, Filippini, Collins, & Biancarosa, 2012). Studies targeting post-secondary ELs' academic vocabulary learning, however, are scarce despite its growing interest and need from the stakeholders. Previous literature examining the topic are limited in quantity; the existing intervention studies largely target either secondary students (e.g., McKeown, Crosson, Moore & Beck, 2018) or students with learning difficulties (e.g., Wright, Pring & Ebbels, 2018).

As researchers have confirmed the positive relationship between post-secondary ELs' academic achievement and their language proficiency (e.g., Rose, Curle, Aizawa & Thompson, 2020; Trenkic & Warmington, 2019), and the role of academic vocabulary considered as the pivot (Townsend, Barber, Carter & Salas, 2020), establishing a knowledge base would provide a foundation upon which further research can be conducted and by which educators can discover, view, and implement best practices. Yet, less has been explored in evaluating effective practices for these learners to be successful in their acquisition and usage of English academic vocabulary. To this end, the present synthesis aims to answer the following research questions: a) What methods have previous research implemented in promoting post-secondary ELs' English academic vocabulary development? and b) What do intervention research related to post-secondary ELs identify as effective strategies to promote English academic vocabulary for post-secondary ELs?

Materials and Methods

Literature Search

The search for relevant articles was conducted with 11 different education and social science databases through EBSCO search interface including ProQuest, Academic Search Complete, Education Full Text, Education Source, Educational Administration Abstracts, ERIC, MLA International Bibliography, Psychology and Behavioral Sciences Collection, APA PsycINFO, Social Sciences Full Text, and Teacher Reference Center. Initially, no publication time parameters were included in order to help the authors determine the full scope of research in this area; once we realized that intervention research on this topic was limited, we did not restrict findings based on publication date.

The search terms used included “academic vocabulary” in conjunction with “ESL,” “EFL,” “ELL,” “English learner,” “L2,” “second language,” “bilingual,” or “linguistically diverse” anywhere in the text but from peer-reviewed journals. Including further parameters such as “advanced” or “adult” yielded 894 articles in total. Seventy-two additional articles were identified through backward search using the reference section of the initially screened articles.

Inclusion and Exclusion Criteria

Prior to the initial full-text screening, the following inclusion criteria were set: 1) English learners (ELs), 2) academic vocabulary, 3) post-secondary setting, and 4) intervention (See Table 1). Studies were excluded if they did not meet all four of the inclusion criteria. The primary reasons for exclusion were that the studies were not interventions, focused on general vocabulary instead of academic vocabulary, or took place with K–12 learners instead of post-secondary students.

Table 1. Inclusion Criteria

Criteria	Description
ELs	Learners whose first language (L1) is a language other than English; those learning English as a second or foreign language
Academic vocabulary	Studies focused on academic vocabulary, such as those on the Academic Word List (AWL; Coxhead, 2000), or studies targeting specialized, technical vocabulary.
Post-secondary	Studies not taking place in K-12 classrooms; included university and work settings requiring technical vocabulary
Intervention	Studies describing treatments, using a comparison group or reporting pre- and post-test results for a single group

Selection Process

After the initial identification through database searching (n=894) and backward searching of references in the initially screened articles (n=72), duplicates have been removed, yielding 807 results. Titles and abstracts were further screened to identify the articles relevant for full-text screening. This resulted in 122 articles, which were further assessed for eligibility; however, only 15 articles met all four of the aforementioned inclusion criteria. Thus, these 15 articles were included in this study (See Figure 1.)

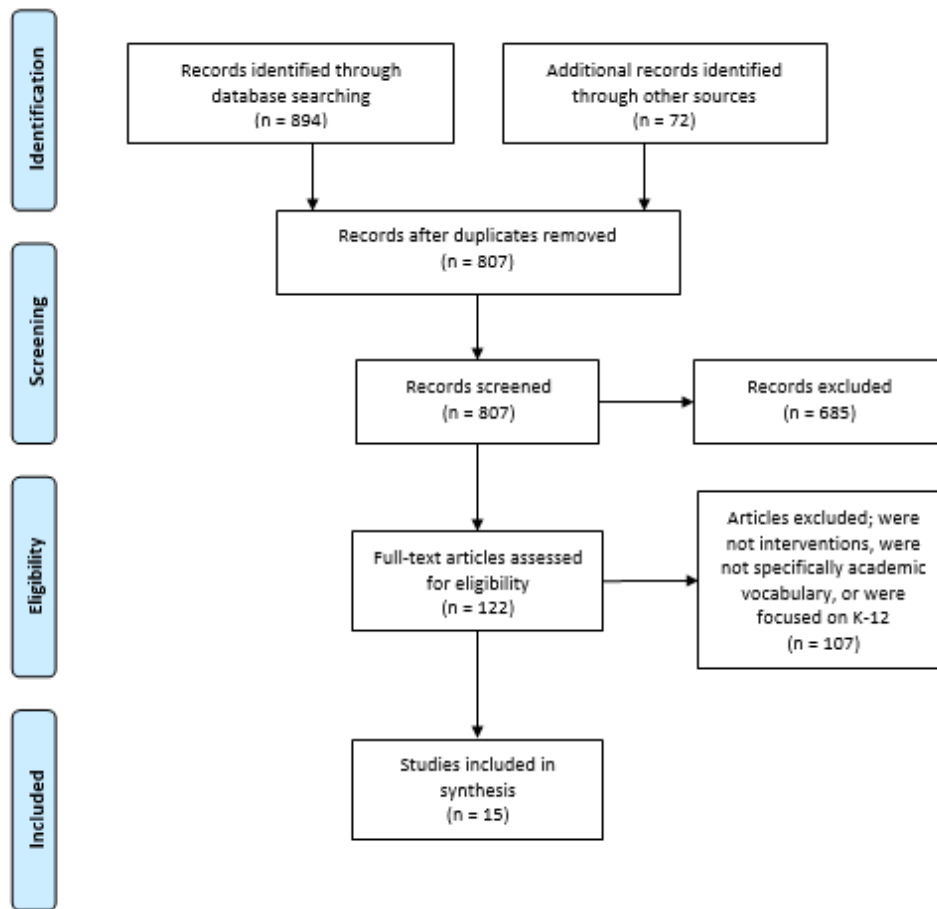


Figure 1. Flowchart of inclusion and exclusion of articles

Data Analysis

Following the initial screening, 15 remaining articles were analyzed using the article matrix (Garrard, 2014) to see differences and similarities between studies that pointed to larger themes, based on the research questions developed for this systematic review. The 15 included articles were initially coded for research design, participant characteristics, intervention procedures and duration, outcomes, assessment instruments, intervention effects, overall study quality, and any additional notes. Yet, utilizing the constant comparative method which combines an analytic use of explicit coding alongside theory generation to extract, formulate and revise themes throughout the analysis (Boeije, 2002), additional themes such as technology were added as they arose in the data to adjust and fit the data.

Results

A summary of the characteristics of each study included in the present study and the percentage of the articles in each category can be found in Table 2 and Table 3, respectively.

Research Question 1: What methods have previous research implemented in promoting post-secondary ELs' English academic vocabulary development?

It was found that the 15 included studies adopted a variety of methods to assist post-secondary ELs' English academic vocabulary development. The following sections present synthesized findings across the 15 included studies including academic vocabulary, receptive and productive vocabulary, technology and intervention effectiveness.

Table 2. Included Studies

Study	Participants	Study Design	Intervention	Words Taught: Isolated, Embedded, Both	Intervention Duration	Receptive, Productive, Both	Use Technology
Alijany et al. (2015)	40 Iranian university students	Exp/Ctrl	Reading authentic academic model essays infused with AWL words	Embedded	9 weeks, 17 sessions	Receptive	No
Ángel & García (2017)	16 Colombian university students enrolled in teacher prep program	2 Exp groups	1 semester of Academic Writing Course	Embedded	1 semester, 4 hours/ week	Productive	Yes
Asmaa et al. (2015)	60 university students in Yemen	Exp/Ctrl	Data-driven learning (DDL) activities + Concordance vs. Dictionary & grammatical collocations	Both	2x each week for 2 hours X 4 weeks = 16 hours	Receptive	Yes
Dizon (2016)	9 Japanese university students	Pre-post, single group	Quizlet	Isolated	3x/week for 10 weeks	Receptive	Yes
Joseph et al. (2009)	32 Japanese university students	Exp/Ctrl	2 different softwares – iTango and iKnow	Isolated	4 weeks, Minimum of 6 hours	Both	Yes
Kaur & Hegelheimer (2005)	18 undergraduates in USA, varying L1s	Exp/Ctrl	Online concordance	Isolated	1x/week for 1 semester	Both	Yes
Kiliçkaya & Krajka (2010)	38 university students in Turkey	Exp/Ctrl	WordChamp – web reader with dictionary capability (glossing)	Both	5 weeks, 3 hours each week (15 total hours)	Receptive	Yes
Lessard-Clouston (2006)	12 graduate students in Canada	Pre-post, single group	Graduate course – Introduction to theology class	Embedded	1 semester	Both	No
Lin & Liou (2009)	25 Chinese university students	Pre-post, single group	3 main features: 1. Explicit instruction 2. Online quizzes 3. Pair writing and individual lexical logs	Both	8 weeks 2 classes per week (Total: 800 minutes)	Both	Yes

Study	Participants	Study Design	Intervention	Words Taught: Isolated, Embedded, Both	Intervention duration	Receptive, Productive, Both	Use Technology
Moskovsky et al. (2015)	120 students at a Chinese Normal University	2 Exp groups	Bottom-up vs. top-down emphasis learning AWL words	Both	48 hours (8 weeks, 6 hrs./week)	Both	No
Pauwels (2012)	59 Dutch students studying to be translators/ interpreters	Exp/Ctrl	5 sets of study materials – each set added different supports and activities	Isolated	5 weeks	Productive	Yes
Poole (2012)	26 freshmen enrolled in a large US university, varying L1s	Exp/Ctrl	3 groups: control, concordance-based, dictionary-based	Both	50 minutes	Both	Yes
Rezaei & Karbalaie (2013)	67 students at English language institutes in Iran	Exp/Ctrl	3 vocabulary learning strategies: 1. Word parts 2. Elaboration techniques 3. Context clues	Both	1 semester	Receptive	No
Tsai (2011)	129 students studying semiconductors in Taiwan	Exp/Ctrl	Multimedia learning software using narrated videos in L1 and L2	Both	7 weeks	Productive	Yes
Zhang et al. (2011)	62 Chinese students	Exp/Ctrl	Vocabulary delivered via text message (SMS) vs. paper-based	Isolated	26 days	Receptive	Yes

Table 3. Percentage of Included Articles in Each Category

Category	Subcategory	Number of the Articles (Percentage)
Academic Vocabulary	Discipline-Specific	2 (13.3%)
Receptive Vocabulary		4 (26.7%)
Productive Vocabulary		3 (20%)
Technology		11 (73.3%)
Intervention Effectiveness	Isolated	4 (26.7%)
	Embedded	3 (20%)
	Concordance	4 (26.7%)

Note: Multiple categories were allowed to be applied to each article.

Academic Vocabulary

While open to both general academic and discipline-specific vocabulary, studies meeting inclusion criteria largely dealt with general academic vocabulary; only two studies (Lessard-Clouston, 2006; Tsai, 2011) focused on discipline-specific vocabulary (theology and semiconductor technology, respectively).

Receptive and Productive Vocabulary

The majority of included studies focused on measuring receptive knowledge or a combination of receptive and productive vocabulary knowledge. Four studies (Alijany et al., 2015; Asmaa et al., 2015; Kiliçkaya & Krajka, 2010; Rezaei & Karbalaeei, 2013) utilized reading passages for receptive vocabulary learning, and reported significant gains. Alijany et al.'s (2015) participants, who read academic texts containing target academic vocabulary, significantly improved their pre- to post-test scores ($t=-8.39$, $p=.001$) while also significantly outperforming the control group on both a post-test ($t=-6.34$, $p=.001$) and a one month delayed post-test ($t=-6.43$, $p=.001$). Asmaa et al. (2015), examining English as a Foreign Language (EFL) students taking an academic reading course, found that both the experimental and control groups scored higher on the post-test than on the pre-test with the experimental group scoring significantly higher on the post-test than the control group ($t=3.155$, $p=.004$). Kiliçkaya and Krajka's (2010) participants improved significantly from pre- to post-test, while the experimental group significantly outperformed the control group on both the post-test ($t(37)=-3.114$, $p=0.004$) and delayed post-test ($t(37)=-3.672$, $p=0.001$). Rezaei and Karbalaeei (2013), who taught an experimental group three vocabulary learning strategies, found that this group scored significantly higher than the control group ($F=118.989$, $p=.000$) as they used word parts, elaboration techniques, and context clues to determine word meanings within their academic reading. Participants in all four studies appeared to benefit from academic reading, which points to the potential of using reading to improve receptive vocabulary knowledge.

Three studies measuring productive academic vocabulary involve specific tools and presentation of materials that appear to aid participants in learning target words, at least in the short-term. Kaur and Hegelheimer (2005) found that those using an online dictionary alongside

concordance software attempted to use more Academic Word List (AWL) words in their writing and to use more academic words correctly than a group using only an online dictionary. Pauwels (2012) gave six groups different sets of study materials and found that the most effective was a thematically-organized word list with L1 glosses or the same list with example sentences; groups with these materials scored significantly higher on the posttest than groups with other materials (e.g., thematically-organized list alone, an organized list with definitions, etc.). These differences, however, disappeared on the delayed post-test. Tsai (2011) found that both face-to-face and courseware-based learners experienced significant gains after a seven-week unit when they were asked to explain the meaning of a discipline-specific term along with its process or purpose.

Technology

Of the 15 included studies, 11 use technology, though the types and the degree of usage varies; some only include a small aspect of technology, like an electronic log (e.g., Pauwels, 2012), while others center their research questions on the effectiveness of using technology to learn academic vocabulary (e.g., Kiliçkaya & Krajka, 2010). The SAMR model (see Table 4) is employed to categorize how each study uses technology (Puentedura, 2013) as it has the benefits to push the bounds of how technology is currently employed in classrooms (Romrell, Kidder & Wood, 2014).

Table 4. SAMR Model Explanation (Adapted from Puentedura [2012])

Category	Explanation	Example
Substitute	Technology is used as a replacement for paper-based methods (interchangeable)	Writing a daily diary entry on a Word document
Augment	Technologically-based version goes beyond substitution and provides functional improvement	Digital textbook provides audio-support and linked definitions
Modify	Technology is used to transform and redesign tasks	An online discussion where participants post links to videos and articles; they can also tag and comment on others' threads
Redefine	Technology is used to create tasks that were not possible non-digitally	Using an augmented-reality software that allows students to experience a historic battle in real-time

Based on the SAMR taxonomy, most studies use technology to augment a vocabulary study method or activity. Out of the 11 studies using technology, two studies used technology simply as a substitute for a paper-based method (Asmaa et al., 2015; Pauwels, 2012) while five used it in a way that augments traditional methods (Ángel & Garcia, 2017; Dizon, 2016; Kaur & Hegelheimer, 2005; Kiliçkaya & Krajka, 2010; Poole, 2012). Three studies used technology to modify a learning task (Lin & Liou, 2009; Tsai, 2011; Zhang et al., 2011), and one study (Joseph et al., 2009) compared an augmenting method with a redefining method.

Puentedura (2013) argues that using technology to modify and redefine tasks can transform learning. This may be particularly true as more digital natives seek to learn and use academic vocabulary. Interestingly, however, the studies in this review seem to conflict with Puentedura's (2013) assertion that modified and redefined uses of technology yield more substantial, transformative results. Of the three studies here that compare a technologically-based method with its paper-based counterpart, only the study using an augmented method (Kiliçkaya & Krajka, 2010)

showed the experimental group outscoring the paper-based group; the two studies using a modified approach either showed insignificant differences (Tsai, 2011) or differences that disappeared in a delayed post-test (Zhang et al., 2011). This runs counter to the premise of the SAMR model that technology which modifies and redesigns tasks transforms learning whereas technology that substitutes and augments paper-based methods simply enhances learning.

Research Question 2: What do intervention research related to post-secondary ELs identify as effective strategies to promote English academic vocabulary for post-secondary ELs?

The following section specifically focuses on the intervention effectiveness of each method utilized in each included study.

Intervention Effectiveness

Isolated vs. Embedded. Four studies using exclusively isolated methods of vocabulary learning all noted gains in receptive vocabulary learning. Zhang et al. (2011) showed that both the experimental and control groups using isolated study materials experienced significant gains that were maintained in a delayed post-test of receptive vocabulary. Joseph et al. (2009) noted significant gains for the experimental group on a receptive task as well as significant improvements of both the experimental and control groups on an assessment of productive vocabulary; both groups used technology-based materials with isolated target words. Dizon's (2016) single-group pre-post study corroborates these findings, noting significant gains in receptive vocabulary for participants who studied using Quizlet, virtual flashcards. Pauwels's (2012) study further informs this idea by finding all six groups experienced benefits from studying words in isolation, though specific pre- to post-test scores were omitted from the report.

Three studies teaching academic vocabulary in context also highlight the potential benefits of embedded vocabulary learning. Alijany et al. (2015) found that experimental group participants who read 15 authentic academic model essays containing target words significantly outperformed a control group on both a post-test and a delayed post-test of receptive vocabulary. Results from Lessard-Clouston's (2006) pre-post single group design also align with these findings; he found that students who were exposed to key academic terms embedded in the context scored higher on a post-test assessing both receptive and productive vocabulary knowledge (gains of 9.21% and 6.4%, respectively). Ángel and Garcia (2017), likewise, noted a high level of productive academic vocabulary usage for both cohorts in their study, though there was no pre-test measure to show gains.

Studies that combined isolated vocabulary learning with context-embedded approach found significant gains in vocabulary learning as well. Moskovsky et al. (2015) noted significant gains when pairing embedded target words with isolated word learning activities. Similarly, post-test scores from Lin and Liou's (2009) single-group study revealed significant gains in vocabulary depth and the ratio of academic words produced in writing. Kiliçkaya and Krajka (2010) and Poole (2012) noted that using isolated word learning tools alongside web-based tools yields greater gains. Poole (2012) found that participants who used isolated web-based word learning tools with target words embedded in academic reading passages exhibited significant gains on receptive and productive vocabulary. In contrast, Tsai (2011) found that not all web-based tools provided added benefits for student learning, including the additional narrated, karaoke-style videos. In Asmaa et al.'s (2015) study, the experimental group using isolated vocabulary learning tools while observing target words in context significantly outperformed the control group on both an initial post-test and a delayed post-test.

Concordance. Four studies indicated different results of concordance-based receptive and productive vocabulary tasks. While Asmaa et al. (2015) found that participants who had access to both a concordance and dictionary significantly outperformed dictionary-only users, Kaur and Hegelheimer (2005) found that concordance-plus-dictionary users did not score significantly differently from a dictionary-only group. However, in the same study, they found that a concordance-plus-dictionary group produced significantly more academic words in a writing task than dictionary-only users, indicating that utilizing a concordance may be effective in productive vocabulary tasks. Poole (2012) found that both a concordance-based group and a dictionary-only group scored significantly higher than a group with neither resource, though the concordance and dictionary groups were not significantly different from one another. Pauwels (2012), comparing study materials of six groups, found that those using only a concordance scored higher on a productive task than both a group using only a dictionary and a group using a concordance with a dictionary.

Discussion

This research synthesis provides a critical review of published research on academic vocabulary interventions for post-secondary ELs and identifies best practices for academic vocabulary learning. Pertaining to the research itself (i.e., studies meeting inclusion criteria), the research in academic vocabulary for post-secondary ELs is lacking, both in quantity and quality. In addition to vaguely reporting procedures and primarily using researcher-created instruments, only ten studies in the past 35 years utilized a true experimental design with a comparison group.

Academic Vocabulary

One finding of this review is that studies for adult ELs related to academic vocabulary are primarily focused on general academic vocabulary and not much on technical or discipline-specific vocabulary. This fits with Lesaux et al.'s (2014) push to focus on words that post-secondary learners may encounter across academic disciplines. However, Green and Lambert (2018) argue for the place and importance of disciplinary literacy with discipline-specific wordlists that may allow users a more accessible entry-point into studying academic words associated with specific fields. The current synthesis, however, indicates an underdeveloped research field related to the actual learning of discipline-specific academic vocabulary in post-secondary education. Though two studies (e.g. Lessard-Clouston, 2006; Tsai, 2011) have attempted to target the discipline-specific vocabulary in exploring an effective way to promote their English academic vocabulary, both focused more on either the technology implemented in the study or the differences in the achievement between native English speakers and non-native English speakers. While the value of general academic vocabulary knowledge is not in question, it is certainly wise to consider how post-secondary ELs develop and acquire discipline-specific academic vocabulary. To this end, future research is needed and encouraged, particularly in the field of academic vocabulary for post-secondary ELs. The current research focuses almost exclusively on general academic words, not on discipline-specific or technical vocabulary. While both are vital for academic learning and participation, each has its own role. Practitioners and researchers would greatly benefit from further intervention studies related to post-secondary students' learning of discipline-specific academic vocabulary, perhaps utilizing the many discipline-specific academic word lists available (e.g., Yang's (2015) Nursing Academic Word List).

Receptive and Productive Vocabulary

As noted earlier, a common categorization in vocabulary, especially in L2 vocabulary, is receptive and productive language (e.g., Townsend & Collins, 2009). When focusing on receptive vocabulary, the included studies here indicate benefits when pairing the learning mode with the assessment mode. They also indicate that consistency is a more important factor than structure or technological innovation when studying receptive vocabulary. For productive vocabulary, the addition of tools such as a concordance can greatly enhance the production of academic vocabulary.

Three studies (Alijany et al., 2015; Asmaa et al., 2015; Kiliçkaya & Krajka, 2010) utilized reading passages for receptive vocabulary learning, and participants in all three studies experienced significant gains. While the role of embedded and isolated vocabulary learning will be further discussed below, the more important finding here may be that learning through a receptive language domain (such as reading) may benefit students when taking an assessment of receptive vocabulary (where they are asked to identify). Aligning vocabulary teaching and learning with the ways in which that vocabulary is assessed coincides with research on ecological validity (e.g., Whitehead, 2008). This raises questions regarding purpose and motivation related to learning and assessing; nevertheless, these studies indicate that matching receptive vocabulary learning with receptive vocabulary assessment is likely to yield higher assessment scores.

While findings from Joseph et al. (2009) and Kaur and Hegelheimer (2005) revealed little or no significant gains on receptive vocabulary, both studies showed more promising results for productive vocabulary. Experimental group's attempts to use more AWL words and correct usage in Kaur and Hegelheimer's (2005) study indicate that participants had better gains in productive vocabulary than receptive vocabulary. This goes counter to most second language research, which indicates that productive vocabulary learning is more difficult than receptive vocabulary learning (e.g., Mondria & Wiersma, 2004). These findings could be related to the age of the participants (older adults) and their level of language proficiency (advanced). Further research on receptive and productive vocabulary learning needs to take the age and the level of language proficiency of the learners into consideration to be able to tease out the effect of these variables.

Technology

While technology provides ever-increasing modes of learning, the research examined in the present study shows that simply substituting technology for traditional vocabulary learning strategies is not enough to yield effect-lasting change; the more important consideration of using technology to learn academic vocabulary is how the words are studied. In fact, technology implemented in the included studies not only present the limitations of technology itself (e.g., storage) but learner characteristics. Depending on learner motivation, proficiency levels and attitudes toward technology in language learning, technology may not yield the same effect in English academic vocabulary acquisition and a solely technology incorporated approach in vocabulary instruction may not be as powerful as a blended approach (Zhang et al., 2011). Thus, further research is needed, targeting how technology can be effectively implemented with learners at various stages of learning, various degrees of motivation and linguistic proficiency as well as the capability with technology, to fully understand the role of technology in vocabulary learning for post-secondary ELs.

Perhaps one of the key factors is that because the research and education communities are still learning how to best use the most up-to-date technology for education, we have yet to design ideal tasks that modify and redefine in a way that truly helps learners. Providing students with engaging means of studying and practicing an academic lexis could be powerful, particularly when those

modified and redefined tasks are personalized and student-paced since most post-secondary students are learning academic English outside of explicit classroom instruction. Thus, this review serves as a call to researchers to design and implement academic vocabulary learning interventions that modify and redefine instead of merely augmenting and substituting for paper-based methods.

Intervention Effectiveness

Isolated vs. Embedded. Findings from multiple included studies point to the benefits of combining embedded academic vocabulary learning with explicit, isolated word learning. Asmaa et al. (2015) and Kiliçkaya and Krajka (2010) both used a combination of intentional target word learning within the context of larger reading passages, showing significant gains. Similarly, Moskovsky et al. (2015) and Lin and Liou (2009) found that combining embedded and isolated academic vocabulary learning produced gains in productive vocabulary as well as in vocabulary breadth and depth. These findings seem to confirm both the power of intentional, direct instruction as well as the benefits of embedded, contextualized vocabulary learning. This coincides with those of August, Artzi, and Barr (2016) and Keisler and Bowers (2012) regarding the primacy of explicit instruction. At the same time, these included studies also confirm findings from Lesaux et al. (2014), who note the importance of learning academic vocabulary in authentic, text-based contexts. This is in line with Worthington and Nation (1996) that suggested a combined approach using some adapted texts, some unsimplified texts, and extensive reading alongside explicit attention paid to a small number of purposefully decontextualized words.

Thus, just as Pinot-Shahov (2012) suggests, viewing receptive and productive language along a continuum, perhaps a similar spectrum is needed here for understanding the interplay between embedded and isolated academic language instruction. On one end of the spectrum, words can be learned solely through lists and definitions with direct, explicit instruction; on the other end of the spectrum, words can be learned incidentally, without direct instruction, solely through reading and incidental exposure. But some learning takes place in the middle of that spectrum, where words may be highlighted or discussed while being learned within a larger context. Six of the studies included here indicate significant possible gains when combining isolated and embedded methods, specifically for academic word learning. Both word learning approaches have their place in academic language learning and appear to work best in tandem.

Concordance. From the research included in the present study, when it comes to productive vocabulary tasks, it appears that: a) using a concordance or dictionary is more effective than using no resources, though using a concordance or a dictionary may yield similar results (Poole, 2012), b) using a concordance and/or dictionary is more effective than other study materials (Pauwels, 2012), and c) using a concordance with a dictionary helps produce more academic words than only using a dictionary (Kaur & Hegelheimer, 2005). While this answers the research question governing this systematic review, they still propose further research questions such as its effectiveness with novice-level learners and different stages in academic vocabulary learning. While a concordance can enhance academic vocabulary learning, the effectiveness of it should be carefully examined, considering various learner characteristics.

Conclusion

This research synthesis highlights important findings from existing research while also alerting the research community to the need for further research in this area. Pertaining to intervention studies on post-secondary ELs' academic vocabulary, the intervention research base has thus far concentrated on general academic over discipline-specific vocabulary and receptive vocabulary

measures. In terms of best practices, post-secondary learners appear to benefit from approaches that combine embedded and isolated practice of target words and utilize tools such as a concordance and dictionary. Additionally, simply including technology in academic vocabulary study is not as important as how academic vocabulary words are taught and studied; instead, practitioners are encouraged to combine technology use with established methods of effective academic vocabulary learning.

Based on best practices examined in the studies included here, we recommend the following for practitioners:

- 1) Combining isolated and embedded practice with target academic vocabulary. This synthesis indicates that EL students benefit from both direct academic vocabulary instruction and contextualized practice with target words embedded in academic texts.
- 2) Explicitly teaching students to use concordances and dictionaries. Providing support through concordances, L1 glosses, and dictionaries further improves academic word learning.
- 3) Strategically providing technological supplements to well-established vocabulary teaching methods (e.g., increased exposures to complex terms, incorporating metacognitive strategies, etc.). Simply including technology does not appear to have a lasting effect on EL students' learning, though providing technologically-based resources in conjunction with solid academic vocabulary teaching does appear to improve acquisition.

In addition, as we continue to discover how to best use technology for educational purposes, we must continue exploring and researching its uses as related to academic vocabulary with post-secondary learners. At present, studies simply using technology to enhance vocabulary learning show greater effects than those using technology to modify and redefine tasks. While using technology to enhance learning may be the best route, it may also be true that we have yet to discover, or accurately observe and report, some of the most effective ways to use technology for modifying and redefining current learning methods. Thus, we encourage practitioners and researchers to continue using technology to enhance established vocabulary-learning practices while also pushing those boundaries and systematically assessing results to help establish knowledge in this area. Particularly as newer technological applications, such as virtual reality simulations and adaptive gaming, become more accessible, we encourage practitioners and researchers to explore these as potential ways to modify and redefine academic vocabulary acquisition tasks.

In sum, the present study reveals that there is still much we do not know about academic vocabulary acquisition for post-secondary English learners. We are hopeful that this synthesis helps provide both practitioners and researchers with a base of information as well as some direction for the future.

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