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Technology and Language – What Works and What Does Not: A Meta-analysis of Blended Learning Research

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This meta-analysis examines the effectiveness of technology employed in language-related blended-learning research by summarizing the outcomes of the measured dependent variables of 59 samples. The effect sizes yielded from the samples were acquired by applying Cohen's (1988; 1992) *d* formula. The estimation was done using the standardized mean difference score, divided by the standard deviation pooled across the treatment and control groups. The findings denote that there is an overall effectiveness to blended-learning; however, the disparity of the effect sizes found implies that the effectiveness is contingent and reliant to the context and how technology is applied. There were also instances of negative effect sizes, suggesting hidden factors that adversely altered the outcomes of the technological intervention. The review also discovered that there is a pattern for performance to be used predominantly as the dependent variable in assessing the effectiveness of the technology. Nevertheless, this should not limit the use of performance as the only measure. Other dependent variables, such as motivation and attitudes, warrant consideration as indicators for measuring the efficacy of a blended-learning intervention.

Keywords: language, blended learning, meta-analysis, learner's performance, secondary dependent variables

Introduction

In an effort to optimize the transmission of knowledge to learners, educators are perpetually working towards inventing more and more effective pedagogical methods to enhance teaching and learning (Leitner, Khalil, & Ebner, 2017; Pollard, Hadjivassiliou, Swift, & Green, 2017). Disquisitions about innovative pedagogical approaches are a hallmark of educators, and this study will focus on one aspect the discussion: technology, and more specifically, blended learning.

Technology offers a novel means for languages, cultures, and the world to be conveyed and understood (Chun, Kern, & Smith, 2016). In fact, in the context of learning among the millennials, technology constitutes a significant contribution (Benson, 2006; Greenhow, Robelia, & Hughes, 2009). Research has established that language learners do incorporate technology into their out-of-class learning repertoire (Inozu, Sahinkarakas, & Yumru, 2010; Murray, 2008). In the context of language teaching and learning, a large and growing body of literature has investigated how language pedagogy has progressed from teacher-focused to student-focused. The shift has created a change towards learning where students, specifically second language (L2) learners, are empowered with a sense of autonomy and heightened motivation (Banditvilai, 2016; Salaberry, 2001). For instance, computer assisted language learning (CALL) researchers have emphasized how technology can enhance language learning and language

proficiency compared to the traditional, face-to-face approach (Blake, Wilson, Cetto, & Pardo-Ballester, 2008). Other researchers have looked at how L2 learners regulate and maintain identity in an online setting (Spiliotopoulos & Carey, 2005; White, 2007), the relationship between intercultural competence and pragmatic development (Zeiss & Isabelli-Garcia, 2005), and how multimedia tools aid language learning (Grgurović, Chapelle, & Shelley, 2013). However, it has also been noted that the nature and sorts of technology used in language learning research is rather restricted and somewhat standard and conventional compared to other disciplines (Howard, & Scott, 2017; Winke & Goetler, 2008; Zhang, 2010). In this field, numerous CALL classes are typically supplemented with language tools or software designed to augment a specific skill. Often, these tools necessitate the use of hardware to warrant the learning process, for instance headphones, microphones, and webcams. This hardware unfortunately may lag behind the latest available software or technology, and this in turn may lead to less access and usage of the technology amongst students.

In addition, the concept and definition of blended learning is often vaguely defined. Existing research in the field of blended learning has acknowledged a variety of definitions involving different tenets of blended learning. For instance, web-based technology and pedagogic approaches may be integrated with face-to-face instruction (Driscoll, 2002), whereas elsewhere blended learning refers to only the use of technology for language pedagogy occurring outside the classroom. The equivocal and inconsistent definitions—as well as the diverse types of technologies employed and anchored on different factors, variables, and contexts—may lead to overgeneralizing the effectiveness of technology in education. The hype over the concept of blended learning has caused many researchers to design and implement technological interventions in the classroom. This observation has fueled the researcher's interest and led to the question of whether these variations of technological use and interventions in the context of language teaching and learning are indeed effective and have a significant impact on learners. In its attempt to address the issues postulated above, this study aims (1) to examine the effectiveness of blended-learning research, as ascertained by measuring effect sizes, and (2) to summarize the outcomes of the measured dependent variables employed in the language-related blended-learning studies through the application of meta-analysis.

Literature Review

The emergence of technology has offered great prospect for cultivating language learning, and in the context of L2 classrooms, blended learning has a distinct function (MacDonald, 2008). Blended learning allows the classroom instructor to coalesce traditional learning with elements of technology which could facilitate a myriad of learning behaviours, as well as different levels of proficiency. Learning is subject to a variety of factors, and educators agree that self-regulated learning strategies play an important role (Ramdass & Zimmerman, 2011). Herein, utilizing technology within the context of L2 learning could reinforce a sense of autonomy whereby learners could benefit tremendously. Undoubtedly, the use of technology for augmenting language teaching has found support among researchers, with numerous studies demonstrating that the insertion of technology into syllabi facilitates language teaching and learning (e.g., Brodskaya & Thiele, 2004; Eugene, 2006; Hixon, 2008; Miner, 2004; Timucin, 2006; Wong 2004).

Studies have shown how technology is effective in assisting the development of teaching approaches and methods, specifically in the aspect of the amplification of students' knowledge (Al-Mekhlafi, 2006; Frigaard, 2002; Timucin, 2006). Although implementing technology in classroom instruction is efficacious and beneficial, some of the previous studies deliberated about the importance of creating learning software grounded in pedagogy and learning theories, whereas others claimed that constructing CALL tools should precede instructional design principles (Allen & Periyasamy, 1997; Armstrong & Yetter-Vassot, 1994; Masters-Wicks, Postlewate, & Lewental, 1996). Arguments have been established on the incorporation of technology in the language teaching and learning context which have shaped

pedagogical approaches employed by language instructors. One such argument concerns the meaningful pedagogic design of CALL activities. Many researchers argue that the design should be student-centered, and numerous studies indicate that positive repercussions from the incorporation of technology include increased motivation, immediacy, and interaction within the landscape of language teaching and learning (Brandl, 2002; Gilbert, 2001; Murday & Ushida, 2002; Ushioda, 1996; Van Aacken, 1999; Warschauer, 1996), thus contributing to one of the important attributes to the success of SLA within computer-assisted environments. In addition to the positive motivation and attitudes among L2 learners, technology allows and encourages learners to be more independent. This aspect of autonomous learning produces an important sense of authority in which learners are responsible for their own learning; such a sense of independence was not permitted with the conventional approach in L2 classrooms (Chapelle & Heift, 2013). However, do all incorporated technologies possess quality and well-thought out designs?

Interaction is imperative for SLA, and circumstances for interaction are feasible in the technology-enhanced language-learning setting. L2 learners are able to discover meaningful environments to negotiate meaning and to integrate learning via interaction and collaboration with others (Okonkwo, 2011). For instance, the use of the social networking website, Facebook, enables more opportunities and possibilities for students to work together using the platform to engage in an environment of collaborative interaction. Thus, technology has facilitated active environments utilizing computer-mediated communication (CMC) in which language learners can participate and contribute, creating a dynamic interaction which in turn results in positive interactions (Blake, 2000; Godwin-Jones, 2011; Kitade, 2000; Lockley, 2011). To exemplify this, Miyazoe and Anderson (2010) stated that writing can be taught in a blended-learning context, and in their research, they also found that the participants improved their skill to distinguish varying English writing styles, and that they have positive perceptions towards blended-learning topics. Hence, it has been shown that language skills can be obtained and learnt in a blended learning environment. However, given the breadth of language and technology research, it is necessary to establish the efficaciousness of blended learning in language learning contexts, as is done in the current study.

Methodology

In order to attain a methodical and structured analysis, the meta-analysis in this study adapted Cooper's (2010, p. 12) seven-stage approach. These stages make up a persistent and iterative procedure. Since each stage is to some degree diverse, the subheadings for every stage mirror the actual approach of the study. As such, the study applies systematic procedures and principles for analyzing research in the area of blended learning in L2 education.

To attain eligible studies, Wiley Online Library, Taylor and Francis Online, Springer, ERIC, Elsevier, ScienceDirect, ResearchGate, ProQuest, JSTOR, IEEE, Sage Journals, APA PsycNET, CALICO Journal, Penn State University Library, Editlib, IGI Global, anitacrawley.net, ascilite.org.au, ajet.org.au, and Questia were searched systematically from the year 1988 to 2015, looking for studies addressing the application of technology in the context of language teaching and learning. Studies prior to 1988 were excluded since prior technology to that time was relatively unsophisticated compared to the current circumstances. The limit of the review was done up to year 2015, when the initial draft was completed. Keywords, such as “control vs. treatment groups”, “blended learning” and “dependent measures”, were utilized to examine published studies. Keywords for “control” and “treatment” indicated interventions, such as with computer-assisted programs and courseware. Keywords for “blended learning” indicated the use of technology in the aspect of delivery and approach of learning materials. Keywords for “dependent measures” indicated how the dependent variable was measured against the independent variable(s).

A total of 3,558 titles were found before a thorough scanning was done. The titles acquired from the searches were scrutinized prior to selection for this study to eliminate those that clearly did not meet the inclusion criteria. Eligible studies were found via local library and inter-library databases as well as via

Google and Google Scholar searches. In addition to the searches, the reference lists of the obtained studies were also scrutinized to look for additional studies to review.

Inclusion Criteria

The number of scholarly research articles chosen for the study was 59 samples, all selected between the years of 1988 to 2015. This included blended-learning samples relevant and pertinent to this study. All articles were validated as pertinent by matching relevant terms acknowledged in the literature on blended learning (Graham, 2006), which included (a) blended, (b) hybrid, and (c) technological intervention. Other terms included "technology", "computer", "web-based instruction", "online", "Internet", "blended learning", "hybrid course", "simulation", "electronic", "multimedia", "Second Language Acquisition (SLA)", "second language learning", "grammatical", "lexical", "oral", "reading", "writing", "speaking", and "vocabulary". The samples encompassed in the meta-analysis were carefully chosen based on a set of detailed criteria adapted from pertinent meta-analysis studies (Bernard et al., 2009; Cook et al., 2008; Means et al., 2013; Means et al., 2010; Sitzmann et al., 2006; Tamim et al., 2011).

Included Samples

The 59 included samples were derived from databases indicated in Table 1 below. It was observed, from various meta-analysis studies, that there was no indication of the minimum or maximum number of studies required for pooled analysis. According to Valentine, Pigott, and Rothstein (2010), "researchers will need to postulate a typical within-study sample size and will also need to either (a) determine the smallest important effect size given the research context or (b) make an educated guess about the effect size that is likely to be found" (p. 233). Moreover, the size of the included sample does not affect multiple comparisons (Pigott, 2012). Table 1 below encapsulates the 59 samples included in this study.

TABLE 1:
Fifty-nine Samples according to Range of Year

Range of Year	No.	Sample	Database
1980 - 1989 (n=2)	1	Casteel (1989)	Editlib
	2	Reitsma (1988)	JSTOR
1990 - 1999 (n=10)	3	Adair-Hauck, Willingham-McLain, & Youngs (1999)	CALICO Journal
	4	Allen (1995)	Sage Journals
	5	Bejarano, Levine, Olshtain, & Steiner (1997)	Elsevier / Science Direct
	6	Cahill & Catanzaro (1997)	Research Gate
	7	Cheng, Lehman, & Armstrong (1991)	Taylor & Francis Online
	8	Liou, Wang, & Hung-Yeh (1992)	CALICO Journal
	9	Owston, Murphy, & Wideman (1991)	Taylor & Francis Online
	10	Shany & Biemiller (1995)	JSTOR
	11	Toro (1995)	Elsevier / Science Direct
	12	Vollands, Topping, & Evans (1999)	Taylor & Francis Online
2000 - 2009 (n=31)	13	Abrams (2003)	Wiley Online Library
	14	Al-Jarf (2004)	Research Gate
	15	Al-Jarf (2005)	Research Gate
	16	Al-Jarf (2007)	Miscellaneous Databases
	17	Bailey (2002)	Penn State University Library

	18	BAŞ & Kuzucu (2009)	CALICO Journal
	19	Blake (2009)	Wiley Online Library
	20	Blake, Wilson, Cetto, & Pardo-Ballester (2008)	Editlib
	21	Chamberlain, Daniels, Madden, & Slavin (2007)	ERIC
	22	Demetriadis & Pombortsis (2007)	Editlib
	23	Fuente (2003)	Taylor & Francis Online
	24	Fujishiro & Miyaji (2009)	Miscellaneous Databases
	25	Gulek & Demirtas (2005)	ERIC
	26	Heiman (2008)	ERIC
	27	Hlas, Schuh, & Alessi (2007)	Sage Journals
	28	Hu, Hui, Clark, & Tam (2007)	IEEE
	29	Kost (2004)	Miscellaneous Databases
	30	Leu, Castek, Hartman, Coiro, & Henry (2005)	Miscellaneous Databases
	31	Maki & Maki (2002)	APA PsycNET
	32	Mioduser, Tur-Kaspa, & Leitner (2000)	Wiley Online Library
	33	Nicolson, Fawcett, & Nicolson (2000)	Wiley Online Library
	34	Pavonetti, Brimmer, & Cipielewski (2002)	JSTOR
	35	Payne & Whitney (2002)	CALICO Journal
	36	Reber (2005)	Research Gate
	37	Rovai & Jordan (2004)	ERIC
	38	Satar & Özdener (2008)	Wiley Online Library
	39	Sequeira (2009)	Miscellaneous Databases
	40	Van Daal & Reitsma (2000)	Wiley Online Library
	41	Woltering, Herrler, Spitzer, & Spreckelsen (2009)	Springer
	42	Young (2008)	CALICO Journal
	43	Zheng, Young, Brewer, & Wagner (2009)	CALICO Journal
2010 - 2015 (n=16)	44	Adas & Bakir (2013)	Miscellaneous Databases
	45	Al-Qahtani & Higgins (2013)	Wiley Online Library
	46	Al-Sorailey-Alqahtani (2010)	Miscellaneous Databases
	47	Behjat, Yamini, & Bagheri (2012)	Questia
	48	Dracopoulos (2012)	Miscellaneous Databases
	49	Farrah & Tushyeh (2010)	Research Gate
	50	Kocoglu, Ozek, & Kesli (2011)	ascilite.org.au / ajet.org.au
	51	Masters, Kramer, O'Dwyer, Dash, & Russell (2010)	Sage Journals
	52	Mekheimer (2012)	CALICO Journal
	53	Moore & Jones (2014)	Sage Journals
	54	Oh, Lee, Park, & Cho (2014)	Miscellaneous Databases
	55	Szymańska & Kaczmarek (2011)	JSTOR
	56	Uzun & Senturk (2010)	Miscellaneous Databases
	57	Vernadakis, Giannousi, Tsitskari, Antoniou, & Kioumourtzoglou (2012)	Miscellaneous Databases
	58	Wichadee (2014)	IGI Global
	59	Zhang, Song, & Burston (2011)	ProQuest

Calculation of Effect Size

To calculate treatment versus control effect size (ES), the indicator used for the purpose of this study was the standardized mean difference score, defined as the difference between the posttest mean of the treatment group and the posttest mean of the control group divided by the standard deviation pooled across the treatment and control groups (Cohen, 1988; Mark, Lipsey, & Wilson, 2001). The mean difference ESs were computed independently for each treatment versus control group, in relevance to samples that comprised of one treatment and one control group, as well as samples that comprised of a number of treatment and control groups. Hence, some samples provided a number of ESs due to the several treatment groups and several outcome measures. According to Rosenthal (1991), the ES is calculated when the mean difference between experimental and control groups are the numerator and the Pooled Standard Deviation (PSD) is the denominator. Samples with data in the form of *t* values, *F* values, *p* levels and frequency are calculated using formulas provided by Mark, Lipsey, and Wilson (2001). For this study, the calculation of the ES employed Cohen's (1988; 1992, p. 157) *d* formula, where the value was derived from the subtraction between the mean value of the experimental group and the mean value of the control group, and subsequently divided with the standard deviation of the experimental group. However, if the value was not provided, a pooled value from both groups were utilized. Formula 1 and 2 were employed as follows.

Formula 1: The ES is the standardized mean difference between two groups

$$d = \frac{Mean(experimental) - Mean(control)}{\ell pooled: Std.dev.}$$

Alternatively, if the mean values were not given, a t-test was used instead. Cohen's *d* in relation to t-test could be employed as the following formula.

Formula 2: Cohen's d in relation to t-test is used as formula

$$d = \frac{t}{\sqrt{df}}$$

- Where *t* is the value of t-test and *df* is the degree of freedom.
- Degree of freedom is computed by the following formula:

$$df = n1 + n2 - 2$$

- Where *n1* is the sample size of the 1st group, and *n2* is the sample size of the 2nd

As mentioned above, the number of ESs yielded by a sample correlates with the number of dependent variables identified. Due to the multiple ESs associated with this method, multi-variable samples, such as with Dracopoulos (2012) and Mekheimer (2012), would need to undergo an additional step in calculation, as opposed to single-variable samples like Abrams (2003), which only required the application of either Formula 1 or 2. In this case, for every multi-variable sample, the average ES was calculated by taking the sum of each ES yielded by the respective dependent variable, and dividing the values by the number of corresponding dependent variables as shown in calculation 1 below.

Calculation 1: Average ES of multi-variable samples

$$Average\ Effect\ Size = \frac{Sum\ of\ Effect\ Size}{Number\ of\ Dependent\ Variables}$$

- Where *Effect Size(ES)* are the individual ES associated with the different dependent variables of a multi-variable sample

Interpretation of Effect Size

ES is a benchmark supplemented by Cohen (1988), used to gauge and to interpret the differences found between two subject groups. Cohen cautiously defined ES across three ranges—(a) "small, d = .2", (b) "medium, d = .5", and (c) "large, d = .8"—stating that "there is a certain risk inherent in offering conventional operational definitions for those terms for use in power analysis in as diverse a field of inquiry as behavioural science" (p. 25).

Results and Discussion

The results are organized into four tables (Tables 2–5). Table 2 displays samples with large and medium ES. Table 3 displays the samples with small ES, meanwhile, Table 4 juxtaposes samples with multiple dependent variables, and Table 5 presents the samples with negative ES. Of the 59 samples, 45 were from single variable samples and 14 were from multi-variable samples. Overall, the results of the synthesized samples indicated the superiority of blended learning approaches. The outcomes of the measured dependent variables are stated in the respective tables.

Table 2 shows the results of the calculation of the mean ES for 18 samples with a single dependent variable reported with large or medium ESs. Twelve samples yielded a large ES whilst six samples yielded a medium ES. It is noted that the preponderance of the dependent variables from this cohort is performance, which is likely linked to how an intervention is measured as a significant predictor for effectiveness and persistence in the learning process. It is noteworthy to highlight that from the findings, 16 samples reported performance as the dependent variable, potentially suggesting a high significant impact of the treatment incorporated in the context of teaching and learning. Scrutinizing the findings, the large and medium effect sizes are allied to the outcome obtained through the administered tests (posttest scores, achievement test, etc.), which is the most common measure of academic achievement. The findings are consistent with those of Rossett, Douglis, and Frazee (2003), who noted the "speedier performance on real world tasks by people who learned through a blended strategy" (p. 1). Besides that, Dziuban, Moskal and Hartman (2005) also posited that the performance of students engaged in blended learning is "as good as, or in some cases better, than face-to-face" (p. 6). Many of the blended learning practitioners and instructors leverage blended environments to improve students' outcomes and performance, for instance, the aspects of language acquisition, such as speaking, reading, and vocabulary attainment, in ways that may not be materialized through the face-to-face contexts. This finding corroborates with samples done by Garrison and Kanuka (2004) and Gray and Tobin (2010), who argued that blended learning enables the attainment of competency. While it may not be or should not be the only indicator to measure effectiveness, there is a positive relation between performance and technology in achieving language learning outcomes.

TABLE 2:
Samples with Large or Medium ES

No.	Sample	Dependent Variable	Outcomes	Effect Size	Strength
1	Behjat, Yamini, & Bagheri (2012)	Performance	Gain in Posttest Reading Performances	3.000	Large
2	Hlas, Schuh, & Alessi (2007)	Performance	Average Number of Words Spoken	2.920	Large
3	Satar & Özdener (2008)	Performance	Speaking Proficiency	1.630	Large
4	Al-Qahtani & Higgins (2013)	Performance	Achievement Test	1.350	Large
5	Al-Sorailey-Alqahtani (2010)	Performance	Overall Grade	1.350	Large
6	Mioduser, Tur-Kaspa, & Leitner (2000)	Performance	Letter Naming	1.200	Large
7	Al-Jarf (2007)	Performance	Posttest Scores	1.180	Large
8	Cahill & Cantazaro (1997)	Performance	Essay Score	1.060	Large
9	Adas & Bakir (2013)	Performance	Student Achievement Scores Posttest	1.000	Large
10	Nicolson, Fawcett, & Nicolson (2000)	Performance	Posttest Reading Standard Score	1.000	Large
11	Sequeira (2009)	Performance	Oral Proficiency Scores	.860	Large
12	Vollands, Topping, & Evans (1999)	Performance	Shortened Edinburgh Group Reading Test	.820	Large
13	Masters, Kramer, O'Dwyer, Dash, & Russell (2010)	Knowledge	Vocabulary Scale Scores	.760	Medium
14	Shany & Biemiller (1995)	Performance	Posttest Reading Comprehension	.760	Medium
15	Fujishiro & Miyaji (2009)	Performance	Pronunciation	.750	Medium
16	Payne & Whitney (2002)	Performance	Gain in Mean Oral Proficiency Score	.690	Medium
17	Zhang, Song, & Burston (2011)	Learning Efficiency	Vocabulary Test Performance	.620	Medium
18	Liou, Wang, & Hung-Yeh (1992)	Performance	Posttest Performance	.550	Medium

Table 3 depicts samples with small and negative ES. It should be noted that the majority of the dependent variables from this cohort is performance. Of the 27 samples, 19 samples reported performance as their dependent variable, four samples reported satisfaction, and the other four samples reported attitude, learning efficiency, knowledge, and motivation as their dependent variables. Four samples generated negative value ES from their samples. A negative ES is obtained when the control group performs better than the treatment group. Specifically, the experimental mean is lower than the control mean, indicating that the technological interventions employed were not effective. At first glance, this large pool of small-effect samples may seem to suggest that the blended learning approaches

implemented were ineffective. An approach that does little to improve the learners' performance does not necessarily equate to a failed approach; for instance, it still might be effective in improving a student's attitude towards a subject. There are other confounding variables which influence performance; for instance, language learners differ in motivation, language proficiency, background, learning styles, and ability to use technology, as well as the instructional context. Even though a given blended-learning approach may have failed to see drastic improvements in performance in the short-term experiment, the learners' improved attitude towards learning, something the researches might have overlooked, could eventually translate to greater performance in the long run when fully implemented. This notion is supported by researchers who suggest that motivated students show greater achievement (Gulek, 2003; Haydel & Roeser, 2002; Roderick & Engel, 2001; Roth & Paris, 1991; White, 1989). However, there is an extent to which small ES is conjectured as a concern. According to Abelson (1985) and Rosenthal (1991), when the effects are prolonged and perpetual, or when a significant number of people are involved, or when the repercussions are tremendous, a small ES is still considered as an important finding which may contribute to interpreting the overall effectiveness of a treatment.

TABLE 3:
Samples with Small ES

No.	Sample	Dependent Variable	Outcomes	Effect Size	Strength
1	Fuente (2003)	Knowledge	Oral Receptive Task Scores	.470	Small
2	Van Daal & Reitsma (2000)	Performance	Posttest Word Reading	.460	Small
3	Blake (2009)	Performance	Speaking Rate	.458	Small
4	Allen (1995)	Performance	Holistic Score	.430	Small
5	Vernadakis, Giannousi, Tsitskari, Antoniou, & Kioumourtzoglou (2012)	Satisfaction	Composite Student Evaluation Score on Satisfaction	.430	Small
6	Casteel (1989)	Performance	Posttest Results	.400	Small
7	Bejarano, Levine, Olshtain, & Steiner (1997)	Attitude	Overall Participation	.380	Small
8	Reitsma (1988)	Performance	Posttest Reading Time	.370	Small
9	Al-Jarf (2005)	Performance	Posttest Scores	.340	Small
10	Gulek & Demirtas (2005)	Performance	Cohort 1 (Grade 8 students) Achievement	.320	Small
11	Al-Jarf (2004)	Performance	Posttest Results	.300	Small
12	Adair-Hauck, Willingham-McLain, & Youngs (1999)	Performance	Cultural Knowledge	.270	Small
13	Leu, Castek, Hartman, Coiro, & Henry (2005)	Performance	Online Reading Comprehension (ORCA-IM) (Final)	.260	Small
14	Szymańska & Kaczmarek (2011)	Performance	Recall Test (After the Placement Test)	.240	Small
15	Bailey (2002)	Satisfaction	Students' Satisfaction	.230	Small
16	Demetriadis & Pombortsis (2007)	Learning Efficiency	Posttest Questionnaire Results	.180	Small
17	Chamberlain, Daniels, Madden, & Slavin (2007)	Performance	Gates Reading Test Total	.140	Small
18	Abrams (2003)	Performance	Gain in communicative units	.130	Small

19	Wichadee (2014)	Satisfaction	Students' perceptions on quality standards	.060	Small
20	Kost (2004)	Performance	Oral Interview and In-Class Writing	.050	Small
21	Kocoglu, Ozek, & Kesli (2011)	Performance	Teaching Knowledge Test Scores	.035	Small
22	Young (2008)	Performance	Listening Proficiency Posttest	.010	Small
23	Pavonetti, Brimmer, & Cipielewski (2002)	Motivation	Title Recognition Test Score	.0002	Small
24	Blake, Wilson, Cetto, & Pardo-Ballester (2008)	Performance	Results from Versant Spanish Exam (Hybrid 2V vs SP 2)	-.020	Small
25	Hu, Hui, Clark, & Tam (2007)	Satisfaction	Learning Satisfaction	-.040	Small
26	Moore & Jones (2014)	Performance	Each Grammar Unit on Cumulative Exam	-.110	Small
27	Rovai & Jordan (2004)	Performance	Learning Posttest	-.440	Small

Table 4 depicts samples with multiple dependent variables documented in this study. Therefore, they produced and fashioned multiple ESs. The table also shows a calculated average ES. In this table, 2 large ESs, 4 medium ESs, and 8 small ESs were reported, making the total samples for the multiple dependent variables 14. One sample was found with negative ESs: Cheng, Lehman, & Armstrong (1991). The juxtaposition demonstrated above by examining the differences of ES among multiple dependent variables may be helpful for researchers who wish to investigate these variables further.

TABLE 4:
Samples with Multiple Dependent Variables

No.	Sample	Dependent Variables and Effect Sizes	Average Effect Size	Strength
1	Toro (1995)	Performance: 2.510; Attitude: -.090	1.210	Large
2	Owston, Murphy, & Wideman (1991)	Performance: .260; Attitude: 2.010	1.135	Large
3	Uzun & Senturk (2010)	Performance: 1.030; Attitude: .450	.740	Medium
4	Reber (2005)	Motivation: .940; Satisfaction: .424	.682	Medium
5	BAŞ & Kuzucu (2009)	Performance: .530; Attitude: .580	.555	Medium
6	Farrah & Tushyeh (2010)	Performance: .090; Attitude: .960	.525	Medium
7	Woltering, Herrler, Spitzer, & Spreckelsen (2009)	Motivation: .410; Satisfaction: .580	.495	Small
8	Dracopoulos (2012)	Performance: .690; Motivation: .270	.480	Small
9	Zheng, Young, Brewer, & Wagner (2009)	Performance: -.160; Attitude: .560; Motivation: .705	.368	Small
10	Mekheimer (2012)	Performance: .310; Attitude: .280	.295	Small
11	Heiman (2008)	Performance: .060; Satisfaction: .470	.265	Small
12	Maki & Maki (2002)	Performance: .430; Satisfaction: -.270	.080	Small
13	Oh, Lee, Park, & Cho (2014)	Performance: .020: Attitude: .170; Motivation: -.120	.023	Small
14	Cheng, Lehman, & Armstrong (1991)	Performance: -.370; Attitude: -.590	-.480	Small

Table 5 shows a summary of samples with negative ES. Although it may be uncommon to have treatments backfiring, there are actually plausible reasons as to why this occurred. Cheng, Lehman, and

Armstrong (1991), one of the samples listed, concluded that the control group's unexpectedly high performance "may have resulted from over-compensatory behaviour or other factors" (p. 62); in other words, unaccounted or uncontrollable factors may have played a role. In concurrence with that notion, Konetes (2009) goes as far as to posit that there are far greater, external "cultural, industrial and global forces that act to influence the field of distance learning and how programs develop" (p. 59). Simply put, an experiment is always at risk of producing unexpected results when certain factors, important yet elusive, are carelessly overlooked. One such hidden factor comes in the form of the Hawthorne Effect, or more commonly referred to as the observer effect. The term was first coined when discovered in the Hawthorne Western Electric Company Plant, Illinois, from 1924-1932; an experiment was run to determine whether the productivity of workers would increase when working conditions were altered (Mayo, 1949). It turned out that irrespective of what changes were made to the conditions, the workers' productivity always improved. In other words, the Hawthorne Effect can overshadow differences between an experimental group versus a control group in experimental research. However, some researchers argue that the inevitability of behavioural change in the context of blended learning research is expected, therefore affecting the outcome of transmuting learning (Brown, 1992; Jones, 1992). Furthermore, another acceptable explanation is the role of confounding variables in the samples included, for instance, existing knowledge and experience, which may have contributed to the results (Bidarra & Rusman, 2017). A fair experiment is done on the assumption that both experimental and control groups are at par in knowledge or skills, but the reality may be that the control group happened to possess the pre-requisite knowledge to outperform the experimental group. Thus, researchers are advised to be cautious when incorporating similar interventions.

TABLE 5:
Samples with Negative ESs

No.	Sample	Effect Size
1	Blake, Wilson, Cetto, & Pardo-Ballester (2008)	-.020
2	Hu, Hui, Clark, & Tam (2007)	-.040
3	Moore & Jones (2014)	-.110
4	Rovai & Jordan (2004)	-.440
5	Cheng, Lehman, & Armstrong (1991)	-.480

Conclusion

This study was conducted with the aim (1) to examine the effectiveness of technological interventions in L2 learning by measuring effect sizes and (2) to summarize the outcomes of the measured dependent variables employed in the language-related blended-learning studies through the application of meta-analysis. The findings from the study suggest an overall effectiveness of blended learning. However, the variation of effect sizes yielded from the analysis suggests that at its core, the effectiveness is contingent and reliant to the context and how technology is applied. At this juncture, the implications of the findings generated from this study can influence the application of specific technology use in language learning, which can be inferred from the respective effect sizes reported. The fact that a number of the included samples reported both large and medium effect sizes, blended-learning practitioners can adapt the findings by replicating similar use of technology. In a similar vein, this study also discerned that several of the included samples fashioned a negative effect size; therefore, it is advisable that these uses of technological interventions be avoided. From the findings, it is also revealed that blended learning has the potential to improve learners' performance. It is important to note that the majority of samples reported performance as the dependent variable. Nevertheless, researchers cannot be too fixated on viewing performance as the sole indicator of the effectiveness of blended learning, nor should they neglect hidden factors, such as the Hawthorne Effect (Mayo, 1949), which can adversely affect an experiment. Having

deliberated on the findings, the researcher recommends that besides focusing on the performance as the sole or primary dependent variable, it is deemed apt for blended learning practitioners to incorporate secondary dependent variables in future investigations. Undoubtedly, performance is the predominant ruler in measuring the efficacy of an intervention implemented; however, secondary dependent variables, such as motivation, are also of importance. Introducing secondary dependent variables such as motivation and satisfaction allow blended learning phenomenon to be investigated with more nuance. The enhancement of the four skills in language learning—reading, writing, listening, and speaking—can be augmented with the aid of technological intervention as part of classroom instruction to create autonomous learners (Banditvilai, 2016; Strotmann, Bamond, Lago, Bailen, Bonilla, & Montesinos, 2014). In summary, as indicated in this meta-analysis, the research demonstrates a far-reaching empirical endorsement for adapting blended-learning techniques in language classrooms, and in many cases, a blended-learning environment has been shown to surpass that of an ordinary classroom without it.

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References

Abelson, R. P. (1985). A variance explanation paradox: When a little is a lot. *Psychological Bulletin, 97*, 129-133.

Allen, J., & Periyasamy, K. (1997). Software engineering principles applied to computer assisted language learning. *CALICO Journal, 14*(2-4), 34-49.

Al-Mekhlafi, A. G. (2006). The effect of computer assisted language learning (CALL) on United Arab Emirates English as a foreign language (EFL) school students' achievement and attitude. *Journal of Interactive Learning Research, 17*(2), 121-142.

Armstrong, K. M., & Yetter-Vassot, C. (1994). Transforming teaching through technology. *Foreign Language Annals, 27*(4), 475-486.

Banditvilai, C. (2016). Enhancing students' language skills through blended learning. *Electronic Journal of e-Learning, 14*(3), 220-229.

Benson, P. (2007). Autonomy in language teaching and learning. *Language Teaching, 40*(1), 21-40.

Bernard, R. M., Abrami, P. C., Borokhovski, E., Wade, C. A., Tamim, R. M., Surkes, M. A., & Bethel, E. C. (2009). A meta-analysis of three types of interaction treatments in distance education. *Review of Educational research, 79*(3), 1243-1289.

Bidarra, J., & Rusman, E. (2017). Key pedagogical and technological factors for effective blended learning design. In G. Ubachs, & L. Konings (Eds.), *The Envisioning Report for Empowering Universities* (pp. 20-23). The European Association of Distance Teaching Universities (EADTU), The Netherlands.

Blake, R. (2000). Computer mediated communication: A window on L2 Spanish interlanguage. *Language Learning & Technology*, *4*(1), 120-136.

Blake, R., Wilson, N. L., Cetto, M., & Pardo-Ballester, C. (2008). Measuring oral proficiency in distance, face-to-face, and blended classrooms. *Language Learning & Technology*, *12*(3), 114-127.

Brandl, K. (2002). Integrating Internet-based reading materials into the foreign language curriculum: From teacher-to student-centered approaches. *Language learning & technology*, *6*(3), 87-107.

Brodskaya, M., & Thiele, R. (2004). Learning community in a combined ESL computer applications course. Retrieved from http://www.cccone.org/scholars/04 05/Marina_Romy_final_report.pdf

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *The Journal of the Learning Sciences*, *2*(2), 141-178.

Chapelle, C. A., & Heift, T. (2013). Individual learner differences in CALL: The field independence/dependence (FID) construct. *Calico Journal*, *26*(2), 246-266.

Chun, D., Kern, R., & Smith, B. (2016). Technology in language use, language teaching, and language learning. *The Modern Language Journal*, *100*(S1), 64-80.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Laurence Erlbaum Associates. *Inc CIT0006*.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155.

Cook, D. A., Levinson, A. J., Garside, S., Dupras, D. M., Erwin, P. J., & Montori, V. M. (2008). Internet-based learning in the health professions: A meta-analysis. *Jama*, *300*(10), 1181-1196.

Cooper, H. M. (2010). *Research synthesis and meta-analysis: A step-by-step approach* (4th ed.). Thousand Oaks, CA: Sage.

Driscoll, M. (2002). Blended learning: Let's get beyond the hype. *E-learning*, *1*(4), 1-4.

Dziuban, C., Moskal, P., & Hartman, J. (2005). Higher education, blended learning, and the generations: Knowledge is power: No more. In J. Bourne, & J. C. Moore (Eds.), *Elements of quality online education: Engaging communities* (pp. 85-102). Needham, MA: Sloan Center for Online Education.

Eugene, J. (2006). How teachers integrate technology and their beliefs about learning: Is there a connection? *Journal of Technology and Teacher Education*, *14*(3), 581-597.

Frigaard, A. (2002). *Does the computer lab improve student performance on vocabulary, grammar, and listening comprehension?* (Unpublished MSc thesis). Winona State University, Wisconsin, USA.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *The Internet and Higher Education*, *7*(2), 95-105.

Gilbert, S. D. (2001). *How to be a successful online student*. New York, NY: McGraw-Hill.

Godwin-Jones, R. (2011). Emerging technologies: Mobile apps for language learning. *Language Learning & Technology*, *15*(2), 2-11.

Graham, C. R. (2006). Blended learning systems. In C. J. Bonk & C. R. Graham (Eds.), *The handbook of blended learning: Global perspectives, local designs* (pp. 3-21). San Francisco, CA: Pfeiffer.

Gray, K., & Tobin, J. (2010). Introducing an online community into a clinical education setting: A pilot study of student and staff engagement and outcomes using blended learning. *BMC Medical Education*, *10*(1), 6.

Greenhow, C., Robelia, E., & Hughes, J. (2009). WLLA 2.0 and classroom research: What path should we take now? *Educational Researchers*, *38*(4), 246-259.

Grgurović, M., Chapelle, C. A., & Shelley, M. C. (2013). A meta-analysis of effectiveness studies on computer technology-supported language learning. *ReCALL*, *25*(2), 165-198.

Gulek, C. (2003). Preparing for high-stakes testing. *Theory Into Practice*, *42*(1), 42-50.

Haydel, A. M., & Roeser, R. W. (2002). *On the links between students' motivational patterns and their*

perceptions of, beliefs about, and performance on different types of science assessments: A multidimensional approach to achievement validation (Report No. 573) Los Angeles, CA: National Center for Research and Evaluation.

Hixon, E. (2008). Team-based online course development: A case study of collaboration models. *Online Journal of Distance Learning Administration, 11*(4). Retrieved from http://www.westga.edu/~distance/ojdla/winter114/hixon114.pdf

Howard, J. M., & Scott, A. (2017). Any time, any place, flexible pace: Technology-enhanced language learning in a teacher education programme. *Australian Journal of Teacher Education, 42*(6). http://dx.doi.org/10.14221/ajte.2017v42n6.4

Inozu, J., Sahinkarakas, S., & Yumru, H. (2010). The nature of language learning experiences beyond the classroom and its learning outcomes. *US-China Foreign Language, 8*, 14-21.

Jones, S. R. (1992). Was there a Hawthorne effect? *American Journal of Sociology, 98*(3), 451-468.

Kitade, K. (2000). L2 learners' discourse and SLA theories in CMC: Collaborative interaction in Internet chat. *Computer Assisted Language Learning, 13*(2), 143-166.

Konetes, G. (2009). The organizational, governmental and external political forces shaping distance education. *International Journal of Instructional Technology and Distance Learning, 6*(1), 59-65.

Lockley, T., & Farrell, S. (2011). Is grammar anxiety hindering English speaking in Japanese students? *JALT Journal, 33*(2), 175-190.

MacDonald, J. (2008). *Blended learning and online tutoring: Planning learner support and activity design* (2nd ed.). Burlington, VT: Gower.

Mark, W., Lipsey, & Wilson, D. B. (2001). *Practical meta-analysis* (Vol. 49). Thousand Oaks, CA: Sage.

Masters-Wicks, K., Postlewate, L., & Lewental, M. (1996). Developing interactive instructional software for language acquisition. *Foreign Language Annals, 29*(2), 217-222.

Mayo, E. (1949). Hawthorne and the western electric company. *Public Administration: Concepts and Cases*, 149-158. Retrieved from http://www.practiceselfreliance.com/wa_files/Hawthorne_20 Studies_201924_20Mayo.pdf

Means, P., Toyana, Y., Murphy, R., & Baki, M. (2013). The effectiveness of online and blended learning: A meta-analysis of the empirical literature. *Teachers College Record, 115*(3), 1-63. Retrieved from http://www.terecord.org/library/content.asp?contentid=16882

Means, P., Toyana, Y., Murphy, R., Bakia, M., & Jones, K. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies*. Washington, D.C.: Office of Planning, Evaluation, and Policy Development, Center for Technology in Learning, U.S. Department of Education.

Miner, T (2004). Using technology to enhance learning: Instructor- or student-moderated discussion boards: Which are more effective? Retrieved from http://www.cccone.org/scholars/0405/TomMiner_final_report.pdf

Miyazoe, T., & Anderson, T. (2010). Learning outcomes and students' perceptions of online writing: Simultaneous implementation of a forum, blog, and wiki in an EFL blended learning setting. *System, 38*, 185-199.

Murday, K., & Ushida, E. (2002, March). *Student experiences in the language online project.* Paper presented at CALICO 2002, Davis, CA.

Murray, G. (2008). Pop culture and language learning: Learners' stories informing EFL. *Innovation in Language Learning and Teaching, 2*, 1-16.

Okonkwo, U. C. (2011). Computer assisted language learning (CALL) software: Evaluation of its influence in a language learning process. *UJAH: Unizik Journal of Arts and Humanities, 12*(1), 76-89.

Pigott, T. (2012). *Advances in meta-analysis.* New York, NY: Springer.

Pollard, E., Hadjivassiliou, K., Swift, S., & Green, M. (2017). *Accelerated degrees in higher education: Literature review.* London, UK: Institute for Employment Studies

Ramdass, D., & Zimmerman, B. J. (2011). Developing self-regulation skills: The important role of

homework. *Journal of Advanced Academics, 22*(2), 194-218.

Roderick, M., & Engel, M. (2001). The grasshopper and the ant: Motivational responses of low-achieving students to high-stakes testing. *Educational Evaluation and Policy Analysis, 23*(3), 197-227.

Rosenthal, R. (1991). *Meta-analytic procedures for social research* (Vol. 6). Thousand Oaks, CA: Sage.

Rossett, A., Douglis, F., & Frazee, R. V. (2003). Strategies for building blended learning. *Learning circuits, 4*(7), 1-8.

Roth, J. L. and Paris, S. G. (1991). Motivational differences in students' perceptions of classroom and standardized achievement tests. Paper presented at the annual meeting of the American Educational Research Association. Chicago, IL: April 3-7.

Sitzmann, T., Kraiger, K., Stewart, D., & Wisher, R. (2006). The comparative effectiveness of web-based and classroom instruction: A meta-analysis. *Personnel Psychology, 59*(3), 623-664.

Spiliotopoulos, V., & Carey, S. (2005). Investigating the role of identity in writing using electronic bulletin boards. *Canadian Modern Language Review, 62*(1), 87-109.

Strotmann, B., Bamond, V., Lago, J. M. L., Bailen, M., Bonilla, S., & Montesinos, F. (2014). Improving bilingual higher education: Training university professors in content and language integrated learning. *Higher Learning Research Communications, 4*(1), 91-97.

Timucin, M. (2006). Implementing CALL in the EFL context. *ELT Journal, 60*(3), 262-271.

Ushioda, E. (1996). Developing a dynamic concept of L2 motivation. In T. Hickey & J. Williams (Eds.), *Language, education and society in a changing world* (pp. 239-245). Clevedon, UK: Multilingual Matters.

Valentine, J. C., Pigott, T. D., & Rothstein, H. R. (2010). How many studies do you need? A primer on statistical power for meta-analysis. *Journal of Educational and Behavioral Statistics, 35*(2), 215-247.

Van Aacken, S. (1999). What motivates L2 learners in acquisition of Kanji using CALL: A case study. *Computer Assisted Language Learning, 12*(2), 113-136.

Wang, M., Shen, R., Novak, D., & Pan, X. (2009). The impact of mobile learning on students' learning behaviours and performance: Report from a large blended classroom. *British Journal of Educational Technology, 40*(4), 673-695.

Warschauer, M. (1996). *Telecollaboration in foreign language learning* (Technical Report #12). Manoa, HI: University of Hawai'i.

White, C. (2007). Focus on the language learner in an era of globalization: Tensions, positions and practices in technology-mediated language teaching. *Language Teaching, 40*(4), 321-326.

White, N. (1989). Developmental relationships between students' attitudes toward reading and reading achievement in grades 1 through 8 (Report No. 040, 143). (ERIC Document Reproduction No. ED 329 905).

Winke, P., & Goertler, S. (2008). Did we forget someone? Students' computer access and literacy for CALL. *CALICO Journal, 25*(3), 482-509.

Zeiss, E., & Isabelli-García, C. L. (2005). The role of asynchronous computer mediated communication on enhancing cultural awareness. *Computer Assisted Language Learning, 18*(3), 151-169.

Zhang, G. M. (2010). *Technology uses in creating second language learning environments: When learners are creators* (Unpublished doctoral dissertation). Michigan State University, Ann Arbor, MI, USA.

Appendix

Abrams, Z. I. (2003). The effect of synchronous and asynchronous CMC on oral performance in German. *The Modern Language Journal*, *87*(2), 157-167.

Adair-Haucks, B., Willingsham-McLain, L., & Youngs, B. E. (1999). Evaluating the Integration of technology and second language learning. *CALICO Journal, 17*(2), 269-306.

Adas, D., & Bakir, A. (2013). Writing difficulties and new solutions: Blended learning as an approach to improve writing abilities. *International Journal of Humanities and Social Science, 3*(9), 254-266.

Al-Jarf, R. S. (2004). The effects of web-based learning on struggling EFL college writers. *Foreign Language Annals, 37*(1) 46-56.

Al-Jarf, R. S. (2005). The effects of online grammar instruction on low proficiency EFL college students' achievement. *Asian EFL Journal, 7*(4), 166-190.

Al-Jarf, R. (2007). Teaching vocabulary to EFL college students online. *Call-EJ Online*, *8*(2), 1-27.

Allen, G., & Thompson, A. (1995). Analysis of the effect of networking on computer-assisted collaborative writing in a fifth grade classroom. *Journal of Educational Computing Research*, *12*(1), 65-75.

AlQahtani, A. A., & Higgins, S. E. (2013). Effects of traditional, blended and e-learning on students' achievement in higher education. *Journal of Computer Assisted Learning*, *29*(3), 220-234.

Al-Qahtani, A. A. (2010). *The effectiveness of using e-learning, blended learning and traditional learning on students' achievement and attitudes in a course on Islamic culture: An experimental study* (Unpublished doctoral dissertation). Durham University. UK.

Bailey, K. D. (2002). *The effects of learning strategies on student interaction and student satisfaction* (Unpublished doctoral dissertation). Pennsylvania State University, Old Main, State College, PA, USA.

Baş, G., & Kuzucu, O. (2009). Effects of CALL method and dyned language programme on students' achievement levels and attitudes towards the lesson in English classes. *International Journal of Instructional Technology and Distance Learning*, *6*(7), 31-44.

Behjat, F., Yamini, M., & Bagheri, M. S. (2012). Blended learning: A ubiquitous learning environment for reading comprehension. *International Journal of English Linguistics*, *2*(1), 97.

Bejarano, Y., Levine, T., Olshtain, E., & Steiner, J. (1997). The skilled use of interaction strategies: Creating a framework for improved small-group communicative interaction in the language classroom. *System*, *25*(2), 203-214.

Blake, C. (2009). Potential of text-based internet chats for improving oral fluency in a second language. *The Modern Language Journal*, *93*(2), 227-240.

Blake, R., Wilson, N. L., Cetto, M., & Pardo-Ballester, C. (2008). Measuring oral proficiency in distance, face-to-face, and blended classrooms. *Language Learning & Technology, 12*(3), 114-127.

Cahill, D., & Catanzaro, D. (1997). Teaching first-year Spanish on-Line. *CALICO Journal, 14*(2-4), 97-114.

Casteel, C. A. (1989). Effects of chunked reading among learned disabled students: An experimental comparison of computer and traditional chunked passages. *Educational Technology Systems*, *17*(2).

Chamberlain, A., Daniels, C., Madden, N. A., & Slavin, R. E. (2007). A randomized evaluation of the success for all middle school reading program. *Middle Grades Research Journal, 2*(1), 1-21.

Cheng, H., Lehman, J., & Armstrong, P. (1991). Comparison of performance and attitude in traditional and computer conferencing classes. *The American Journal of Distance Education, 5*(3), 51-64.

Demetriadis, S., & Pombortsis, A. (2007). E-lectures for flexible learning: A study on their learning efficiency. *Educational Technology & Society, 10*(2), 147-157.

Dracopoulos, E. (2012). *Second language writing anxiety, computer anxiety, motivation and performance in a classroom versus a web-based environment* (Unpublished master's thesis). McGill University. Canada.

Farrah, M., & Tushyeh, H. (2010). Enhancing the English reading and writing skills of Palestinian English majors by using CALL. *Hebron University Research Journal, 5*(2), 259-282.

Fuente, M. J. (2003). Is SLA interactionist theory relevant to CALL? A study on the effects of computer-mediated interaction in L2 vocabulary acquisition. *Computer Assisted Language Learning, 16*(1), 47-81.

Fujishiro, N., & Miyaji, I. (2009). Effectiveness of blended instruction in class on the skills of oral reading and speaking in English. *Educational Technology Research, 32*, 79-90.

Gulek, J. C., & Demirtas, H. (2005). Learning with technology: The impact of laptop use on student achievement. *The Journal of Technology, Learning, and Assessment*, *3*(2), 3-38.

Heiman, T. (2008). The effects of E-mail messages in a distance learning university on perceived academic and social support, academic satisfaction, and coping. *The Quarterly Review of Distance Education, 9*(3), 237-248.

Hlas, A. C., Schuh, K. L., & Alessi, S. M. (2007). Native and non-native speakers in online and face-to-face discussions: Leveling the playing field. *Journal of Educational Technology Systems, 36*(4), 337-373.

Hu, P. J., Hui, W., Clark, T. H. K., & Tam, K. Y. (2007). Technology-assisted learning and learning style: A longitudinal field experiment. *IEEE Transactions on Systems, Man, and Cybernetics – Part A: Systems and Humans, 37*(6), 1099-1112.

Kocoglu, Z., Ozek, Y., & Kesli, Y. (2011). Blended learning: Investigating its potential in an English language teacher training program. *Australasian Journal of Educational Technology, 27*(7), 1124-1134.

Kost, C. R. (2004). *An investigation of the effects of synchronous computer-mediated communication (CMC) on interlangauge development in beginning learners of German: Accuracy, proficiency, and communication strategies* (Unpublished doctoral dissertation). University of Arizona, US.

Leitner, P., Khalil, M., & Ebner, M. (2017). Learning analytics in higher education: A literature review. In A. Pena-Ayala (Ed.), *Learning analytics: Fundaments, applications, and trends* (pp. 1-23). Springer, Cham.

Leu, D. J., Castek, J., Hartman, D., Coiro, J., Henry, L., Kulikowich, J., & Lyver, S. (2005). Evaluating the development of scientific knowledge and new forms of reading comprehension during online learning. *Final report presented to the North Central Regional Educational Laboratory/Learning Point Associates*, 108-127.

Liou, H., Wang, S. H., & Hung-Yeh, Y. (1992). Can grammatical CALL help ELF writing instruction? *CALICO Journal, 10*(1), 23-44.

Maki, W. S., & Maki, R. H. (2002). Multimedia comprehension skill predicts differential outcomes of web-based and lecture courses. *Journal of Experimental Psychology: Applied*, *8*(2), 85-98.

Masters, J., Kramer, R. M., O'Dwyer, L. M., Dash, S., & Russell, M. (2010). The effects of online professional development on fourth grade English language arts teachers' knowledge and instructional practices. *Journal of Educational Computing Research, 43*(3), 355-375.

Mekheimer, M. A. (2012). Assessing aptitude and attitude development: In a translation skills course. *CALICO Journal*, *29*(2), 312-340.

Mioduser, D., Tur-Kaspa, H., & Leitner, I. (2000). The learning value of computer-based instruction of early reading skills. *Journal of Computer Assisted Learning, 16*, 54-63.

Moore, J., & Jones, K. (2014). The journalism writing course: Evaluation of hybrid versus online grammar instruction. *Journalism and Mass Communication Educator, 70*(1), 6-25.

Nicolson, R. I., Fawcett, A. J., & Nicolson, M. K. (2000). Evaluation of a computer-based reading intervention in infant and junior schools. *Journal of Research in Reading, 23*(2), 194-209.

Oh, J., Lee, H. K., Park, M., & Cho, Y. (2014). Exploring the effects of tablet PC-based English learning. *English Teaching*, *69*(3), 151-176.

Owston, R. D., Murphy, S., & Wideman, H. H. (1991). On and off computer writing of eighth grade students experienced in word processing. *Computers in the Schools: Interdisciplinary Journal of*

Practice, Theory, and Applied Research, 8(4), 67-88.

Pavonetti, L. M., Brimmer, K. M., & Cipielewski, J. F. (2002). What are the lasting effects on the reading habits of middle school students exposed to accelerated reader in elementary grades?. *Journal of Adolescent & Adult Literacy, 46*(4), 300-311.

Payne, J. S., & Whitney, P. J. (2002). Developing L2 oral proficiency through synchronous CMC: Output, working memory, and interlanguage development. *CALICO Journal, 20*(1), 7-32.

Reber, R. (2005). Accessing motivational factors in educational technology: The case of building a web site as a course assignment. *British Journal of Educational Technology, 36*(1), 93-95.

Reitsma, P. (1988). Reading practice for beginners: Effects of guided reading, reading-while-listening, and independent reading with computer-based speech feedback. *Reading Research Quarterly, 23*(2), 219-235.

Rovai, A. P., & Jordan, H. M. (2004). Blended learning and sense of community: A comparative analysis with traditional and fully online graduate courses. *International Review of Research in Open and Distance Learning, 5*(2).

Satar, H., & Özdener, N. (2008). The effects of synchronous CMC on speaking proficiency and anxiety: Text versus voice chat. *The Modern Language Journal, 92*(4), 595-613.

Sequeira, C. A. (2009). *Synchronous computer mediated communication and second language proficiency* (Unpublished doctoral dissertation). University of Oregon, Eugene, Oregon.

Shany, M. T., & Biemiller, A. (1995). Assisted reading practice: Effects on performance for poor readers in grades 3 and 4. *Reading Research Quarterly, 30*(3), 382-395.

Szymańska, A., & Kaczmarek, A. W. (2011). Reading efficiency in blended learning context. *Teaching English with technology, 11*(2), 29-42.

Toro, M. A. (1995). The effects of HyperCard authoring on computer-related attitudes and Spanish language acquisition. *Computers in Human Behavior, 11*(3-4), 633-647.

Uzun, A., & Senturk, A. (2010). Blending makes the difference: Comparison in blended and traditional instruction on students' performance and attitudes in computer literacy. *Contemporary Educational Technology, 1*(3), 196-207.

Van Daal, V. H. P., & Reitsma, P. (2000). Computer-assisted learning to read and spell: Results from two pilot studies. *Journal of Research in Reading, 23*(2), 181-193.

Vernadakis, N., Giannousi, C. M., Tsitskari, E., Antoniou, P., & Kioumourtzoglou, E. (2012). A comparison of student satisfaction between traditional and blended technology course offerings in physical education. *Turkish Online Journal of Distance Education, 13*(1), 137-147.

Vollands, S. R., Topping, K. J., & Evans, R. M. (1999). Computerized self-assessment of reading comprehension with the accelerated reader: Action research. *Reading & Writing Quarterly: Overcoming Learning Difficulties, 15*(3), 197-211.

Wichadee, S. (2014). Factors related to students' performance of hybrid learning in an English language course. *International Journal of Distance Education Technologies, 12*(1), 74-90.

Woltering, V., Herrler, A., Spitzer, K., & Spreckelsen, C. (2009). Blended learning positively affects students' satisfaction and role of the tutor in the problem-based learning process: Results of a mixed-method evaluation. *Advances in Health Science Education, 14*, 725-738.

Young, D. J. (2008). An empirical investigation of the effects of blended learning on student outcomes in a redesigned intensive Spanish course. *CALICO Journal, 26*(1), 160-181.

Zhang, S., Song, W., & Burston, J. (2011). Reexamining the effectiveness of vocabulary learning via mobile phones. *The Turkish Online Journal of Educational Technology, 10*(3), 203-214.

Zheng, D., Young, M. F., Brewer, R. A., & Wagner, M. (2009). Attitude and self-efficacy change: English language learning in virtual worlds. *CALICO Journal, 27*(1), 205-231.