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Learning from a transactional distance: a systematic review of distance education for second and foreign language learning

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Abstract

Conventionally, the education of languages and most disciplines are delivered in classrooms, where teachers and learners communicate and interact in face-to-face, real-time and physical settings. The norm of conventional education (CI) has been revolutionised by the coronavirus disease of 2019 (COVID-19), a global pandemic that circumscribed physical and in-person interaction, and leading to an unprecedented and worldwide suspension of classroom teaching. To minimise the prolonged disruption to education, distance education (DE) has become the normative practices of teaching and learning, which are often conducted via web-based and computerised media and technology so that teachers and learners could communicate from a virtual distance. The popularisation of DE has attracted far-reaching interest from stakeholders of education to contemplate the role of DE in the wake of the pandemic. On the one hand, some perceive the pandemic as a catalyst of paradigmatic shift from CI to DE, while others are sceptical of the effectiveness of DE. In view of this controversy, this paper aims to examine the effectiveness of DE in the field of second and foreign language learning (SLL/FLL) by conducting a systematic review that synthesises empirical evidence, and with a rigorous and transparent methodology that ensures reliability, validity and overall quality of findings.

Although DE came into existence over a century ago, it is a complicated domain in which there is an absence of universal standardisation in defining, categorising, evaluating or theorising the concepts and applications. By addressing these four issues, this paper laid the foundation for conducting the systematic review in manner of conceptual and theoretical consistency, preciseness and clarity. Firstly, based on a detailed and comprehensive review of literature, this paper defines DE as an 'umbrella concept' encompassing a composition of widely accepted definitions that are collectively applicable to an extensive variety of contexts. Secondly, this paper categorises DE by three modes of synchrony: the asynchronous, synchronous, and blended modes. The asynchronous and synchronous modes could be conceptualised by separate schools of thoughts in areas of media and technology, pedagogy and philosophy, and the blended mode combines the two divergent modes into the design and practice of DE. Thirdly, the effectiveness of the three modes could be compared

according to four groups of results, including the outcome of second language (L2) learning, perception and attitude of teachers and learners, motivation of learners, and the emotion of learners. Finally, this paper adopts the theoretical framework of the transactional distance theory (TDT), which has over five decades of theoretical development and empirical investigations. TDT is arguably qualified as a global theory that compendiously encapsulates various media and technology, pedagogy and philosophy, and converges with other theories and concepts in the field of DE. TDT hypotheses an inverse relationship between the level of transactional distance (TD) and the degree of effectiveness in DE. TD is conceptualised as the barrier between teachers and learners that prohibits learning in DE, and as the function of three variables: the level of structure (or rigidity) of the DE course (i.e. How rigid or flexible is the course in catering to the individual needs of learners?); the level of dialogue between teachers and learners, and learners and contents (i.e. How interactive is the course?); and the level of learner autonomy (i.e. To what extent are learners capable of learning independently and making learning decisions for themselves?)

This paper aims to address three research questions, including the extent to which different DE modes (i.e. asynchronous, synchronous and blended) are effective in SLL/FLL of DE, the extent to which TD levels are different across the DE modes, and the relationship between the levels of TD and effectiveness of the DE modes. Based on the aforesaid review of current knowledge that addresses the conceptual, empirical and theoretical issues in the field of DE, there are three hypotheses of the research questions. Firstly, owing to the difference in media and technology, philosophy and pedagogical approach, the magnitude and types of outcome are likely to vary according to the synchrony of instruction (i.e. DE categories). Secondly, TD levels in each DE mode could be different depending on the instructional design and implementation of SLL/FLL in DE. Since the blended mode might demonstrate the benefits of both asynchronous and synchronous modes, and is generally favoured in the current generation of DE, it is hypothesised that the blended mode is more likely to yield more positive outcomes. Thirdly, TD is a barrier to learning and is inversely correlated with the effectiveness of DE, and a similar relationship is hypothesised to manifest in SLL/FLL of DE.

An elaborate methodology was designed based on the best practices of comparable systematic reviews, while adapting to the circumstances of this study. A systematic process of database search and flow of studies was followed, and articles were screened based on a standardised set of inclusion and exclusion criteria. The included studies are empirical studies that have been peer-reviewed, examined at least two DE modes (i.e. synchronies), complied with the definitions synthesised in the literature review, and satisfied a reasonable standard of weight of evidence (WOE) to ensure the quality of research. The process of screening, reviewing, documenting and confirming the included articles were conducted by a reviewer and two checkers to increase inter-rate and intra-rater reliability of the findings.

Following the procedures set out in the methodology, 31 articles were winnowed from the original sample of 308 articles on the basis of relevance to the current study, adequacy of details and clarity, validity and quality of findings (WOE), and inter-rater and intra-rater reliability. Published in the span of two decades, the body of research exhibits a representative sample of empirical investigations, embodying a diverse variety of characteristics, backgrounds and contexts, countries and regions, educational settings, L1s and L2s, L2 skills and proficiency levels, research design, data collection methods, lengths of investigation, participant types, sample sizes, types and concurrent applications of media and technology, and measurements in the categories of L2 learning, perception and attitudes, emotion and motivation.

By comparing the TD levels, scores of TD variables, measurements and results of L2 courses conducted in three DE modes, a number of distinct findings were observed. The blended mode was associated with the lowest levels of TD and the higher proportion of positive results, whereas the asynchronous mode exhibited a higher levels of TD but a smaller proportion of positive results In contrast, the synchronous mode was associated with the highest levels of TD and the lowest proportion of positive results. Last but not least, the number of media and technology concurrently applied was greatest in courses conducted in the blended mode, followed by the asynchronous mode, and the least in the synchronous mode. These findings affirm the hypotheses of the three research questions. It could be concluded that there is cogent evidence to associate DE modes with TD levels and the results of DE courses. Finally,

the limitations of the systematic review, recommendations and the possible future of DE are discussed.

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List of acronyms and abbreviations

ACMC	Asynchronous computer-mediated-communication
BL	Blended learning
CALL	Computer assisted language learning
CL	Collaborative learning
CLT	Communicative language teaching
CI	Classroom instruction
CMC	Computer-mediated communication
DE	Distance education
EFL	English as a Foreign Language
ESL	English as a second language
L1	First language
L2	Second language
FL	Foreign language
ICT	Information and communication technology
MALL	Mobile assisted language learning
ODL	Open and distance learning
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SCMC	Synchronous computer-mediated-communication
SDL	Self-directed learning
SL	Second language
SLL/FLL	Second/foreign language learning
SNS	Social networking sites
TBLT	Task-based language teaching
TD	Transactional distance
TDT	Transactional distance theory
VBI	Video-based instruction
WBI	Web-based instruction

1. Introduction

1.1 Background

1.1.1 COVID-19 and education

Since the outbreak in late 2019, the coronavirus disease of 2019 (COVID-19) has escalated to a lasting global pandemic, bringing sweeping changes to conventional forms of social activities and interpersonal interactions (World Health Organisation, 2020). To contain viral transmission and prevent further outbreaks, widespread and prolonged public health measures such as social distancing and prohibition on group gathering have been imposed. Hence, teachers and students were no longer able to convene or interact physically in traditional classrooms, creating the "largest disruption of education systems in history, affecting nearly 1.6 billion learners in more than 190 countries and all continents" (United Nations, 2020, p. 2) and resulting in unprecedentedly far-reaching and adverse consequences (UNESCO, 2020a, 2020b). In response to the suspension of education institutions, physical contact in traditional classrooms has been replaced by digital communication powered by information and communication technology (ICT), thereby enabling educational activities to take place at a safe and virtual distance for teachers and students around the world (Reimers & Schleicher, 2020; UNESCO, 2020c, 2020d, 2020e; World Bank, 2020; World Economic Forum, 2020).

1.1.2 Distance education (DE)

To substitute and complement face-to-face teaching and learning in the midst of social distancing and physical class suspensions, scores of alternative methods have been introduced in a wide range of educational settings during the pandemic. Digital and web-based technology has become the overarching enabler of these alternative forms of education, which are referred to as e-learning (Almaiah et al., 2020), online learning (Dhawan, 2020; Hockly, 2015), computer-assisted language learning (CALL) (Beatty, 2013; Levy, 1997), computer-mediated communication (CMC) (Marani et al., 2020),

digital learning (Mulenga, & Marbán, 2020), open and distance learning (ODL) (Bates, 1997), web-enhanced learning and distance learning, to name a few. It is worth noting that these commonly used terminologies are loosely interchangeable and synonymous (Guri-Rosenblit, 2005; Guri-Rosenblit & Gros, 2011; Moore et al., 2011; Whittaker, 2013), and these terminological variations are not standardised in terms of how they are defined and operationalised in theoretical and empirical investigations. Moreover, a vast array of technological tools have been fashioned during and even prior to the pandemic, creating a diversity of interactional and instructional methods between teachers and learners. A principal differentiation of educational approach is asynchronous and synchronous modes of instruction, which are conducted at different times or in real-time respectively (Hrastinski, 2008; Simonson & Seepersaud, 2019; Watts, 2016). In some cases, asynchronous and synchronous modes of instruction, and even face-to-face teaching, are integrated into a hybrid form of teaching, known as blended learning or distributed learning (e.g. Bordoloi et al., 2020; Dede, 1996b; Jowsey et al., 2020; Kich, 2016; Ożadowicz, 2020). It is evident that a diverse array of teaching and learning practices fall outside the realm of conventional education in physical classrooms. The wide-ranging class of alternative education is generally classified as 'distance education' (hereafter referred to as DE), a conceptualisation that comprehensively and flexibly encapsulates the various forms of educational approaches and practices involving the separation of teachers and learners (Keegan, 1980; Moore & Kearsley, 2012).

Prior to the pandemic, DE has already been widely adopted in educational practices and categorised as an independent field of academic research for decades (Brookfield, 1985; Candy, 1991; Holmberg, 1977; Keegan, 1980, 1996; Moore, 1972; Moore & Kearsley, 2012; Munro, 1991, 1998; Pratt, 1988; Shale, 1990). Amidst the COVID-19 pandemic, the pervasive application of DE has further propelled empirical investigations into the effectiveness of different instructional methods and across diverse educational settings, which are expounded in the following sub-section.

1.1.3 Arguments in support of DE

Hailed by international organisations, researchers, educators and policy makers as a pragmatic solution of education in the interim period, DE has been termed the 'panacea for the crisis' (Dhawan, 2020), with empirical support in areas of teacher-learner interaction (Lee et al., 2021), feedback to learners (Presti, 2020), improvement of learning efficiency (González et al., 2020) and students' acceptance (Allo, 2020; Lee et al., 2021; Sujarwo et al., 2020). Against the backdrop of supportive policies and research findings, the pandemic is argued to have paved the way for an expeditious and permanent departure from traditional face-to-face practices, or 'classroom instruction' (henceforth CI), to DE (Dhawan, 2020; Pokhrel & Chhetri, 2021). It is envisaged that the digitalisation of education will accelerate (Özer & Suna, 2020), perpetuating DE as a predominant mode of teaching and learning beyond the global pandemic (Cesco et al., 2021; Kitishat et al., 2020; Lockee, 2021; Zhu & Liu, 2020). The application of internet technologies is predicted to be long-lasting in a myriad of disciplines, such as native language education (Süğümlü, 2021), second and foreign language education (Pustika, 2020; Risner, 2021; Villagrá, 2016), dentistry (Chavarría-Bolaños, 2020; Haridy et al., 2021), medicine (Brady & Pradhan, 2020), engineering (Qadir & Al-Fuqaha, 2020), and also at different educational levels (Kohnke & Moorhouse, 2021) and countries (Pham & Ho, 2020).

1.1.4 Arguments against DE

While the rapid migration of in-person classes to online delivery might support the continuation of education during the pandemic, sceptics are incredulous of such impromptu and transitory strategies (Ng et al., in press), which are construed as 'emergency remote education' (ERE) and without an assurance of quality. It is argued that by cobbling up classes for online delivery, ERE emphasises on the continuity of schooling at times of crises, but lacks the systematic planning, theoretical basis, empirical validation of effectiveness (Bozkurt et al., 2020; Bozkurt & Sharma, 2020; Erarslan, 2021; Hodges et al., 2020; Moser et al., 2021). Hence, there are cautions against losing sight of

the "simplistic and opportunistic" (Williamson et al., 2020, p. 104) design of ERE, and to avoid embracing the premature and unverified optimism of digital communication in education. As a matter of fact, empirical findings of DE during the pandemic have also unveiled numerous drawbacks. From the teachers' perspective, there are issues of increased workload and stress (Marek & Chew, 2021), a dearth of technological literacy and necessary training (Sari & Nayır, 2020), difficulty to control learners' misconduct (Elsalem et al., 2021; Herdian et al., 2021), to name a few. For learners, the complications of learning remotely amidst the pandemic include poor internet connectivity (Adnan & Anwar, 2020), lack of speaking practices in second language courses (Karataş & Tuncer, 2020), insufficient self-discipline and concentration (Sun et al., 2020), and even absenteeism (Mouchantaf, 2020). The compulsory and acute transition to DE, also known as 'Forced Online Distance Education' (FODE), is associated with unintentional side effects for both teachers and students (Dolenc et al., 2021).

1.1.5 DE before the pandemic

DE has emerged as an alternative pedagogical approach for approximately half a century. Thanks to the cost-effectiveness, ubiquitous accessibility, flexibility of pacing, and malleability of curricular design afforded by DE (Inglis, 2003, 2007; James & Beattie, 1996; Jung, 2003; Jung & Lee, 2013; Rumble, 2003), there has been a trend of advocating and deploying digitalisation in education prior to the pandemic (Casey, 2008; Peters, 2002; Simonson et al., 2019), with a greater number of institutions converging CI with DE (Tait, 1999) and offering pure or hybrid forms of web-based teaching (Kraemer, 2008a) that meet the demands of students (Appana, 2008; Moore, 2008). The effectiveness of DE is claimed to be comparable to that of CI (Aragon et al., 2002; Gonzales & de Montes, 2001; Moore & Thompson, 1990; Verduin & Clark, 1991). DE is also part of the reformation of universities to address institutional problems, such as overcrowding and priority of research over teaching (Peters, 2000). In addition to the growing prevalence of DE in developed countries (Saba, 2012), factors such as globalisation (Arbelaez, 2016; Mason, 1998), internationalisation (Irele, 2013), new

technology (Brown & Brown, 1994), international agencies and the private sector have also precipitated non-formal education in developing countries (Baggaley & Belawati, 2010; Perraton, 2006).

In view of the potential of DE, optimists are predicting the outlook of 'a new paradigm in learning' (Harasim, 2000). By surmounting the physical constraints of location, venues, teaching capacity, scheduling, threshold of class sizes, instruction methods and the higher cost of face-to-face teaching, DE is championed as a more convenient, borderless, instantaneous and affordable learning option for a wider audience who would otherwise have been hindered by the limiting factors above (Laidlaw & Layard, 1974; Moore & Kearsley, 2012; Rumble, 1997; Taguchi, 2015). For instance, DE has the potential to economise and cater for the learning needs of working adults, overseas and remote students, and individuals without the necessary time, in-person availability or resources to participate in CI (Holmberg, 1981; Keegan, 1980). DE is also perceived positively as a satisfying and student-centred approach to learning (Sahin & Shelley, 2008). The strengths of DI have been attested by a number of meta-analyses, which aggregated the results of numerous research studies that compared favourably with those of CI (Allen et al., 2004; Means et al., 2013; Shachar & Neumann, 2003; Sitzmann et al., 2006).

In spite of the benefits of DE, there are claims that CI maintains a higher status (Moreira, 2016), thus widespread adoption of DE has met resistance or inertia from educational institutions, teachers and students (Annand, 1999; Burston, 2014, 2015; Feenberg, 1999; Renes & Strange, 2010; Valentine, 2002). Learners who prefer imbibing knowledge in CI might be reticent about the quality and level of engagement in teaching that are seemingly impersonal (Natale & Libertella, 2016; Vasilevska, 2017), and are sceptical of the readiness and availability of technological resources (Doyumğaç et al., 2021). One of the negative consequences is attrition, as learners drop out of DE courses (Nielson, 2011). Teachers who are accustomed to imparting content in CI might lack the incentive or initiative to change the status quo, and might be constrained by limited pedagogical and technical know-how (Yang & Cornelious, 2005). Moreover, teaching online could be significantly more time-intensive than in CI (Palloff & Pratt, 2001, Smith et al., 2001)

and cause fatigue for both teachers and learners (Kruglova et al., 2021; Zhao et al., 2021). Educational institutions might be reluctant to invest and develop distance-taught courses that would be incompatible with the existing programmes (Blanch, 1994; Wingo et al., 2017). Furthermore, ICT knowledge is needed for both teachers and learners (Simonson, 2005), and there are other related challenges, such as inaccessibility of devices, or digital divide, and concerns of data privacy (Ng et al., in press; UNESCO, 2020f).

1.1.6 DE at a crossroad

It is uncertain whether the pandemic marks the watershed that catalyses a fundamental, paradigmatic shift from CI to DE, or merely precipitated a makeshift that fills the void of social distancing during the temporary closure of schools and educational institutions. In view of the mixed findings and manifold nature of DE, there is no concrete support and the actual implication of the pandemic on the future of education is far from conclusive at present (Pather et al., 2020).

Studies conducted during the pandemic have generally reported both advantages and limitations of DE (e.g. Gao & Zhang, 2020; Kamal et al., 2021; Ozamiz-Etxebarria et al., 2021). Similarly, some meta-analyses and reviews of research on DE prior to the pandemic also reported mixed findings, with negligible effect sizes and insignificant differences between DE and CI (Appana, 2008; Bernard et al., 2004; Cavanaugh et al., 2001, 2004; Johnson, 2008; Lin, 2015; Setyaningsih, 2020; Sitzmann et al., 2006; Zhao et al., 2005). Overall, empirical studies comparing the quality of DE and CI are largely inconclusive (Shachar, 2008). Different countries, educational institutions and strata might not be equally ready to switch to DE during and after the pandemic (e.g. Al Lily et al., 2020; Crawford et al., 2020; Dolenc et al., 2021; Doghonadze et al., 2020). Moreover, DE has been applied in diverse contexts; the quality, rigor and appropriateness of instructional methods and design may vary extensively (Bernard et al., 2010, 2014; Russell, 1999b). Furthermore, the complexity of DE is compounded by the influence of social, organisational, technical and global variables (Zawacki-Richter et al., 2009). Instead of choosing between DE and CI, some advocate combining of CI and DE into a

hybrid form of education (Paudel, 2021). On the whole, a more balanced presumption is that face-to-face format will resume, but "special arrangements…put in place during the COVID-19 crisis will leave a lasting trace" (Daniel, 2020, p. 95).

While the outlook of DE remains controversial and noncommittal, there is a general consensus to further examine the design, application and the consequential effectiveness of DE, so as to shed light on how the study, practice and policy in the overall field of education should evolve beyond the pandemic.

1.2 Rationale

Examining the future of DE begs the fundamental question: how effective is DE? In fact, the effectiveness of DE is a subject of longstanding debate (e.g. Buck, 2010; Montelpare & Williams, 2000; Moore, 1997; Navarro, 2000), and the quest for such answers has generated a substantial volume of research and literature. Quality assurance, the system that ensures learning effectiveness (Nash, 2016a), has played an integral role in conferring imprimaturs for educational institutions to deliver accredited DE (Bates, 2000; Claus, 2006; Lezberg, 2003; O'Brien, 2013; Rovai & Downey, 2010; Stella & Gnanam, 2004), and would expectedly influence the adoption of DE in the wake of the global pandemic (Shehzadi et al., 2021). As an abundance of empirical studies and perspectives exist, stakeholders of DE and education would benefit from obtaining a relatively objective understanding of the major findings from the current state of knowledge in DE. To provide an opportune synthesis of research findings that is reliable and useful for stakeholders to act upon, a systematic review is therefore undertaken to search for relevant literature exhaustively; include relevant empirical studies according to procedures that reduce systematic biases; condense findings that reflect the current state of knowledge (Macaro, 2020; Petticrew & Roberts, 2006) and within the framework of a theoretical model (Siddaway, et al., 2019).

1.3 Foci of the study

According to Hoadley (2016), research in the field of e-learning, the predominant form of DE, should ideally be connected to theoretical support, usefulness of tools and activities, and the constraints of applications in DE. To accomplish the aforesaid objectives in a systematic and manageable manner, there are a number of issues that lie within the purview of this study. These issues relate to the definitions, categorisation, theoretical underpinning, dimensions of effectiveness, and the scope of DE. These issues are illuminated in the following sub-sections.

1.3.1 Definitions and categorisation of DE

The first issue pertains to defining and categorising DE systematically, which is necessary for a number of reasons. Firstly, the field of DE is broadly defined as "a wide spectrum of technologies to reach learners at a distance" (Greenberg, 1998, p. 36), encompassing a multifarious "family of instructional methods" (Moore, 1973, p. 664), pedagogical approaches and theoretical bases (Bernard et al., 2014; Dede, 2008). The delivery of DE could be further complicated when instructional materials and methods are combined (Moore, 1990a), formulating various forms of hybrid designs (Albiladi & Alshareef, 2019). Secondly, constant innovation of instructional methods and educational technology are rendering the field of DE increasingly varied (Hampel, 2019). The emergence of new categories of educational technology could be exemplified by the advent of mobile learning (Alzahrani & Laxman, 2016; Attewell et al., 2010; Chee et al., 2017; Hockly, 2013), mobile assisted language learning (MALL) (Chinnery, 2006), use of artificial intelligence (Kannan & Munday, 2018), gamification (Canipe, 2016; Kasurinen & Knutas, 2018), virtual reality (Chen, 2016), to name a few. Thirdly, reviews of empirical studies suggest that the field of DE abounds with inconsistent definitions and conceptualisations (Bozkurt et al., 2015; King et al., 2001; Tallent-Runnels et al., 2006) and an incoherent knowledge of practice (Garrison, 2000), impeding the establishment of a common understanding and guideline of best practices (Goel et al., 2012).

Since a consistent understanding of what DE entails is imperative to good pedagogical design (Biggs, 1999), there is a need to standardise the definitions and categorise the main types of instructional methods and approaches in DE according to their technological, instructional, pedagogical and theoretical characteristics. To address the long-standing "questions of terminology, definition and identification in an effort to contribute to the theory of distance education" (Keegan, 1980, p. 14), this study explores an overarching and unified categorisation whereby the taxonomy and dimensions of different types of DE could be examined and compared systematically.

1.3.2 Theoretical underpinning of DE

The practice of delivering education from a distance could be traced back to 1800s, which were marked by sequent generations of evolving practices and theories (Bates, 1995; Black, 2013; Cannell 1999; Patterson, 1996; Taylor, 2001; Thompson, 2007). In the recent five decades, DE has drawn noticeable academic interest (e.g. Amundsen, 1993; Armstrong & Yetter-Vassot, 1994; Blake, 1987; Cononelos & Oliva, 1993; Evans & Nation, 1992, 1993; Garrison, 1993a, 1993b, 2000; Holmberg, 1983, 1983, 1995, 2003; Jensen, 1993; Keegan, 1993; Moore, 1972, 1973, 1990; Peters, 1983, 1989, 1993, 1998, 2007; Saba, 1988). Originally stigmatised as inferior to face-to-face teaching, DE gradually became more accepted as a legitimate form of education (e.g. Arif, 2001; Merisotis & Phipps, 1999), and the last decade has seen a rising importance and proliferation of DE research and practices across diverse contexts (e.g. Garrison, 2016; Martin et al., 2011; Martin et al., 2020). However, a considerable body of research of DE is regarded as atheoretical (Moore, 2003; Perraton, 2000; Saba, 2000), and criticised as "lack[ing] solid foundations to sustain theoretical advances in the field" (Birochi & Pozzebon, 2011, p. 562). Researchers have therefore called for the need to "verify and solidify DE's conceptual foundation" (Saba & Shearer, 1994, p. 36) through theory-driven empirical research (Lee et al., 2006) and developing a coherent body of knowledge in the subject (Stepanyan et al., 2013).

A sound theoretical underpinning is essential to obtaining a comprehensive understanding of DE, uncovering the underlying assumptions of its pedagogy, guiding the instructional design, learning and teaching processes, and evaluating the learning outcome (Mayes & de Freitas, 2007). However, there is an absence of a 'global theory' that "reflects the complete continuum and is inclusive of a full range of practices" (Garrison, 2000, p. 12) in the field. Hence, the present study surveys and takes stock of prominent perspectives of DE in search of a 'global theory' that could reasonably be generalised to the variety of categories and contexts of DE, and systematising the major variables affecting the effectiveness of DE.

1.3.3 Empirical findings of second and foreign language learning (SLL/FLL)

The third focus of this study is to draw on the empirical evidence of second and foreign language learning (henceforth SLL/FLL) as the basis for evaluating the effectiveness of DE, thereby generating findings that identify the merits and limitations. As theoretical and practical guidance are warranted for teachers, instructional technologists and other stakeholders to improve the quality of education (Anglin & Morrison, 2000; Littlejohn, 2004), this study also aims to advance the understanding of DE with reference to the practical applications in SLL/FLL.

The reason for delineating the scope of SLL/FLL is threefold. Firstly, there is a growing importance of DE in SLL/FLL. According to Blake (2017), the application of DE to SLL/FLL is "becoming commonplace, whether in support of traditional, blended, or fully online formats" (p. 157). Secondly, notwithstanding the increasing application of DE in SLL/FLL (Wang & Winstead, 2016), its importance has not been commensurately reflected in the recent research trends of SLL/FLL (Tan, 2016; Van Deusen-Scholl & Hornberger, 2008), and the number of systematic reviews of SLL/FLL is decidedly underrepresented in the overall research of DE. Based on an exploratory research in the education databases, including ProQuest, SCOPUS and Education Collection (incl. ERIC), there is a scant number of systematic reviews of SLL/FLL in DE. The studies conducted are focused on particular languages, instructional method and contexts

(Lambert, 2020; Macaro et al., 2012; Persson & Nouri, 2018), with many reviews not conducted systematically (e.g. Blake, 2016; Luo & Yang, 2018; Sauro, 2011). Moreover, the scarcity of systematic reviews of SLL/FLL in DE pale in comparison with the sheer volume of systematic reviews in the education of other disciplines, such as dentistry (e.g. Botelho et al., 2018; Santos et al., 2016), health sciences (e.g. Liu et al., 2016; Jin & Bridges, 2014), nursing (e.g. Du et al., 2013; Voutilainen et al., 2017), science and mathematics (e.g. Bano et al., 2018). To put this into perspective, a systematic review of e-learning research conducted between 2010 and 2018 had reported that the predominant subjects were health and engineering education (Rodrigues et al., 2019). In addition, the most recent systematic review of SLL/FLL in DE is relatively out-dated (Vorobel & Kim, 2012), which is consisted of studies published between 2005 and 2010; it was also concluded in the review that the question of whether it is "possible to teach an L2 or FL at a distance" (p. 549) was not fully answered.

Undoubtedly, the above findings reflect an insufficient emphasis on research activities in the field of SLL/FLL and DE, and a gap of more recent systematic reviews of empirical studies. It is worth noting that the study of SL and FL and particularly the impetus of learning English worldwide are playing a preeminent role in popularising DE globally (Dannenberg, 2016), thus accentuates the importance of the topic and provides an additional justification for undertaking the present study. Last but not least, in view of the breadth of the field of DE but the limited scale of the present study, setting out a systematic review that concentrates on the subfield of SLL/FLL could ensure that the investigation is reasonably manageable and in-depth.

1.3.4 Dimensions and variables of effectiveness

Effectiveness in DE is difficult to be defined with clarity due to the complexity, variety and constant evolution of instructional approaches and educational technology (Meyer, 2002), thus behooves researchers to perform a clearer and updated examination of the construct. Taking the construct at face value, effectiveness in DE could be fathomed as positive learning results and features that are conducive to fulfilling the educational

objectives. In theoretical and empirical studies of DE, diverse indicators and dimensions of effectiveness have been conceptualised and investigated (Esfijani, 2018; Shelton, 2011). Some of the common aspects of effectiveness include learning and performance outcomes (Lockee et al., 2002; Williams, 2006), academic achievement (Cavanaugh, 1999), satisfaction of learners (Allen et al., 2002; Sahin & Shelley, 2008) and teachers (Gómez-Rey, 2016), engagement (Schindler, 2017) and dropout rate (Bernard et al., 2008; Garrison, 1987; Levy, 2007; Sweet, 1986). In addition, there is a plurality of variables that might affect the effectiveness of distance learning (Nortvig et al., 2018), such as the design quality of course content (Sun & Chen, 2016), the role of instructors (Maor, 2003; Yang & Cornelious, 2005), learner motivation (Liao, 2006), personality (Besser et al., 2020), student support (Rekkedal & Qvist-Eriksen, 2004), social presence (Picciano, 2002; Richardson & Swan, 2003), acceptance of technology (Lee et al., 2003, 2005), psychological readiness (Rosen & Weil, 1995), anxiety (Bervell & Umar, 2020), emotions (Hurd, 2007, 2008), functionality (Hagel & Shaw, 2006), perception of interaction (Fulford & Zhang, 1993), the actual extent of interaction between students, the teacher and content (Bernard et al., 2009), and various barriers to DE (Muilenburg & Berge, 2005). In view of multifactorial and multidimensional nature of DE effectiveness, this study attempts to delineate and analyse the common dimensions of effectiveness reported in SLL/FLL studies of DE.

1.4 Outline

This paper is a systematic review of empirical studies that examined SLL/FLL in DE. As a synopsis, the structure of this paper is organised into eight chapters. Following this introductory chapter, the second chapter is dedicated to the literature review of the definitions, categorisations, theories and empirical research of DE. The chapter of literature review is divided into four sections, addressing four broadly framed questions:

1. What is DE?
2. What are the categorisations of DE?
3. What are the current findings of DE effectiveness?

4. How to theorise the effectiveness of DE?

Chapter 3 details the methodology of the present study, namely a systematic review of the empirical studies of DE in the field of SLL/FLL. This chapter elaborates on the research questions, hypotheses, descriptions and rationales of the research procedures, data collection, inclusion and exclusion criteria of studies, tools of data screening, databases of research, use of backward and forward citation tracking, and measures to improve the reliability and quality of this study.

Chapter 4 presents the results of the study, including an overview of the research and an extensive and organised report of the key findings. Guided by the research questions, Chapter 5 discusses the findings in detail to extrapolate the effectiveness of DE, and accounts for the outcomes in accordance with the DE categorisation and theoretical framework propounded in the literature review. The study is then critically evaluated in Chapter 6, pinpointing the limitations of the methodology and findings. Based on the discussion of findings and limitations, Chapter 7 puts forth recommendations on future research and practical implications. Finally, Chapter 8 concludes this paper with a summary of the key outcomes, relevance to stakeholders and a comment on the future of DE.

2. Literature review

2.1 What is DE?

2.1.1 Definitions of DE

The notion of DE could be literally understood as delivering education from a distance outside traditional classroom settings. This definition corresponds with Shale's (1990) plain statement, remarking DE "ought to be regarded as education at a distance" (p. 334). While this literal understanding might afford the flexibility to incorporate assorted and evolving practices, defining DE as any activities outside conventional CI may be arbitrary and imprecise. An ill-defined conception that is neither specific nor coherent could be prone to inconsistencies and might induce ambiguity of knowledge and practice in the field.

Since the inception of DE in 1800s and its gradual popularisation in the recent five decades (Birnbaum, 2001; Gunawardena & McIsaac, 2004; Hanson et al, 1997; Mehrotra et al., 2001; Meyer, 2002;; Wedemeyer & Najem, 1969), an inordinate array of definitions and iterations have been advanced by numerous researchers and practitioners. However, the perspectives and assumptions of DE remain considerably varied, as "theorists disagree on its defining features" (Adams, 2013, p. 338). In spite of endeavours towards reviewing and standardising the discrepancies (Keegan, 1980, 1989), there is no clear consensus on a universally accepted definition (Garrison & Shale, 1987). Hence, a tenable approach is to conceptualise DE as an "umbrella term" (Keegan, 1996) that is malleable, multifaceted, and encompassing a wide range of definitions. Having said that, definitions comprising of different constructs that are elusive, loosely conceptualised and arbitrarily interchangeable might be confusing and misleading (King et al., 2001). Hence, the criteria that constitute DE should be rigorously and comprehensively defined, and "serving as a guide or standard to which something can be compared or evaluated" (Garrison & Shale, 1987, p. 10). As the study and practice of DE is constantly modified by the advent of new technologies and pedagogical development, this paper refines the

"umbrella concept" by synthesising the extensive definitions of earlier and recent perspectives, explicating inconsistencies and illuminating the requisite criteria that commonly characterise the broad and complex concept.

2.1.1.1 Commonalities

The descriptions in Figure 2.1 juxtapose the common and compatible criteria that chronologically represent the widely referenced definitions of DE between 1969 and 2021 (extracted from 'Appendix 1: Definitions of distance education' for complete quotations):

- a learning methodology that is self-paced and accommodates learners' own needs (Wedemeyer & Najem, 1969);
- a "family of instructional methods in which the teaching behaviours are executed apart from the learning behaviours…so that communication between the teacher and the learner must be facilitated by print, electronic, mechanical or other devices." (Moore, 1973, p. 664);
- "a method of imparting knowledge, skills and attitude [involving] extensive use of technical media, especially for the purpose of reproducing high quality teaching material" (Peters, 1973, p. 206);
- allowing learners to work individually or in a group (Flinck, 1975, 1978);
- a learning environment of physical separation, or a 'quasi-permanent separation' between learners and teachers (Bruder, 1989; Keegan, 1996; Perraton, 1988; Rumble, 1989) and where communication is largely not continuous or contiguous (Garrison & Shale, 1987; Holmberg, 1977);
- a pedagogical phenomenon rather than a medium of instruction that bridges geographical distance and unites the learner and teacher (Keegan, 1996);
- "the influence of an educational organization both in the planning and preparation of learning materials and in the provision of student support services (this distinguishes it from private study and teach-yourself

programmes)" (Keegan, 1996, p. 50)

- "a planned teaching/learning experience that uses a wide spectrum of technologies to reach learners at a distance" (Greenberg, 1998, p. 36);
- "a pedagogical concept…describing the universe of teacher-learner relationships that exist when learners and instructors are separated by space and/or by time" (Moore, 1997, p. 22);
- supports "one-to-one relations" (Holmberg, 2003, p. 14), two-way communication (Bååth & Flinck, 1973; Moore, 1975, 1977) and/or mass communication (Holmberg, 1985);
- a systematic, planned and formal learning activity and student-teacher arrangement (Coe & Elliott, 1999; Delling, 1966; Miller et al., 2003) that takes place where "the teacher is not present at the same time or place as the student" (Hassenburg, 2009, p. 7) and are "separated by geographic distance or by time" (Appana, 2008, p. 5);
- "institution-based, formal education where the learning group is separated, and where interactive telecommunication systems are used to connect learners, resources, and instructors" (Schlosser & Simonson, 2010, p. 1);
- media and technologies that should complement with learning objectives, course design, content, interaction and pedagogy (Moore & Kearsley, 2012; Russell, 1999a).

Figure 2.1 Definitions of distance education (DE)

Common threads of the definitions could be identified. In sum, these general criteria conceptualise DE as a learning methodology that is planned and managed by educational institutions following a set of course objectives, design and pedagogy, and employs instructional methods involving a wide spectrum of media or technology that facilitate the communication and relationship between learners and teachers who are separated physically and temporally.

For the most part, the criteria are concordant with earlier attempts to specify the components or elements that are composed of a capacious set of DE definitions (Keegan, 1980; Rumble, 1989), but a critical analysis of some criteria allude to possible inconsistencies. An all-round synthesis of definitions should be cognizant of commonalities as well as inconsistencies among the definitions, and also taking into account the relevance of alternative terminologies with connotations that are synonymous with DE. The issue of inconsistency and alternative terminologies are discussed in the ensuing sections.

2.1.1.2 Inconsistencies

2.1.1.2.1 DE as a replication of CI

The definitions of DE reflect two distinct notions of its nature. On one hand, DE is defined as the replication of traditional face-to-face CI, which is parallel to the processes in face-to-face education (Shale, 1990), providing a "guided didactic conversation" that resembles or emulates orthodox CI practices (Holmberg, 1977; Keegan, 1993; Mottet, 1998; Ostendorf, 1997), and with "the purpose of reproducing high quality teaching material" (Peters, 1973, p. 206). In traditional classroom education, learning takes place in the same place and time (Hannay & Newvine, 2006), and media and technology are employed with the purpose of minimising or removing the separation of physical, geographical, and temporal presence in DE (Appana, 2008; Gibson 1998; Hassenburg, 2009; Keegan, 1996; Moore, 1997). According to the equivalency theory, the aim of DE is to replicate CI as closely as possible (Simonson, 1999) by leveraging the capacity of educational technology in creating realistic learning experience. In other words, DE should ideally achieve a state of equivalency to CI. This is epitomised by the application of synchronous computer-mediated-communication (SCMC), which involves real-time and high-quality internet communication that is designed to replicate traditional classroom teaching by bridging the physical, geographical and temporal separation. In other words, synchronous instructions are time-sensitive but unrestrained by distance (Barker & Dickson, 1996). To support synchronous communication, various internet-

based tools are commonly applied, such as videoconferencing, interactive multimedia and instantaneous chatroom (refer to 'Appendix 2: Definitions of media and technology' for a comprehensive list of synchronous media and technology).

2.1.1.2.2 DE as a distinct type of education

It is debateable whether DE should be considered the proximate form of CI, or a distinct type of education in itself. DE has been conceptualised as "a form of indirect instruction" (Peters, 1973, p. 104), which is "a different concept of learning from that acquired in school" (Wedemeyer, 1981 p. 111) and "a separate mode of education in its own right" (Holmberg, 1995, p. 51). In other words, DE is argued to be distinct from traditional face-to-face CI. In principle, the common promulgation of 'learning anywhere, anytime' (Bourne et al., 2005; Bromley, 2010; Shear, 2003; Veletsianos & Houlden, 2019) implies that DE is fundamentally different from the educational approach that recreates physical proximity and real-time learning. Another differentiating factor is learner autonomy, which is considered one of the distinguishing features of DE (Saba, 2003). This perspective is resonated by Wedemeyer and Najem (1969), who claimed that students "would be able to move largely at their own pace and go from area to area, course to course, as their needs matured" (p. 9). This centricity on learners' decisions of learning content and pacing is supported by the asynchronous mode of DE, which is less bounded by the schedules or progress of classes that typically dictate synchronous classes and CI.

Instead of approximating traditional CI, DE follows pedagogically sound principles and practices that are centred on the characteristics of educational technology (Driscoll et al., 2012). For instance, DE might be designed and delivered asynchronously as a standalone mode of pedagogy (Edwards et al., 2000). Examples of the asynchronous mode may include asynchronous computer-mediated-communication (ACMC), emails, blogs and wikis (refer to 'Appendix 2: Definitions of media and technology' for a comprehensive list of asynchronous media and technology). Unlike DE courses that are delivered synchronously, asynchronous courses are not necessarily time dependent (Bernard et al., 2004). In other words, asynchronous courses could be characterised as 'different-time,

different-place' (DT-DP) (p. 7), as opposed to 'same-time, different-place' (ST-DP) in synchronous courses (Simonson et al., 2000).

Despite an absence of real-time interactions, the asynchronous mode could still fulfil the definitional criteria of supporting "two-way communication between (among) teacher and students for the purpose of facilitating and supporting the educational process" (Garrison & Shale, 1987, p. 11) and allowing learners to engage "in some form of communication" (Jung, 2001, p. 532). In some cases, asynchronous communication may lead to better interaction and relationship between students and teachers (Swan, 2001), as instantaneous or CI interactions could be cognitively and emotionally overwhelming (Challob et al., 2016; Miyazoea & Anderson, 2012). Research has found that effective design of asynchronous instructions could engender the richness of communication and interaction associated with CI (Vonderwell, 2003). From the perspective of cost-effectiveness, teachers remain demanded in synchronous instructions of DE to perform real-time teaching; such human constraints could be reduced in the asynchronous mode, making DE more economical and scalable.

2.1.1.3 Sources of inconsistencies

2.1.1.3.1 Impact of educational technology

The burgeoning development of educational technology may diversify the types of practices and broaden the range of DE criteria (Rodrigues et al., 2019). It could be justifiably postulated that technological and pedagogical sophistication over time have endowed greater capacity and affordances of DE (Weller, 2020), repurposing its function as a substitute of CI to a more mainstream form of contemporary education (Saykılı, 2018). For instance, when DE was conducted through correspondence courses in the 1970s, DE was defined as merely a 'fringe form of ordinary teaching' (Peters, 1973, p. 207). In earlier research conducted before or at the turn of the 21st century, empirical studies generally reported ambivalent results or insignificant differences between the outcome of DE and CI (Allen et al., 2002, 2004; Harris & Parrish, 2006; Liu &

Thompson, 1999; Schmidt, 2002; Tucker, 2001; York, 2008), compared with apparently more affirmative results in recent studies (e.g. Bagapova et al., 2020; Núñez et al., 2019; Roux et al., 2014). A similar observation was reported by a systematic literature review of online learning definitions, showing a relationship between the evolution of the concept and definitions with the advancement of technology between 1988 and 2018 (Singh & Thurman, 2019).

The evolution of definitions over the decades indicates that the DE criteria are not immutable. The continuous enhancement of educational technology might have surpassed the limitations envisioned by earlier definitions. With the availability of web-based conferencing and streaming communication technology, the norm of DE definitions might have changed from asynchronous to synchronous, and possibility to blended forms of instruction (Bernard et al., 2004). Moreover, an early definition of DE as "the quasi-permanent absence of learning groups" (Keegan, 1990, p. 44) might be exceedingly restrictive or obsolete, in light of the abundant examples of group learning in the designs of synchronous and asynchronous pedagogies (e.g. Hausstätter & Nordkvelle, 2007). By the same token, other early definitions underscored the characterisation of temporal and physical dissociation (Harasim, 1993; Savard et al., 1995). From the experiential standpoint of teachers and learners, such separation of time and physical presence could well be rendered obscured by the improving capabilities of artificial intelligence, digital teachers, augmented and virtual reality in creating the high fidelity simulation of real-time and authentic in-class experience for students (Ally, 2019; Dickey, 2005a; Hedberg & Alexander, 1994; Helsel, 1992). This is resonated by the argument that contemporary education is contingent on dialogic virtual space created by communication technology instead of physical space (Wegerif, 2007). Moreover, the format of communication in DE might no longer be instructional per se, as educational technology continues to embody new features of interactions, such as gamification, educational entertainment (Edu-tainment), and even learning with fictional identities in virtual worlds (Annetta et al., 2010; Elaish et al., 2018; de Fossard, 2008; Dickey, 2005b; Zainuddin et al., 2020). Formulating an enduring and sound conceptualisation of DE proves to be complicated, as it appears that definitions that set an upper bound on the capacities and format of DE

might eventually lag behind the development of educational technology and even become at odds with the latest pedagogies.

2.1.1.3.2 Related and synonymous terminologies

Apart from the advancement of educational technology, another source of complexity associated with demarcating the scope of DE is concepts that are closely related, synonymous and overlapping. The connection between various concepts of DE has been extensively explored (e.g. Thompson, 2007), and a large number of literature and studies have highlighted the challenge of differentiating and defining a wide range of terminologies, which are often referenced interchangeably and haphazardly but without univocal or consistent definitions (Guri-Rosenblit, 2005; Guri-Rosenblit & Gros, 2011; Moore et al., 2011; Wilson, 2012). For instance, some equate DE with distance learning (DL) (Adams, 2016), but this convention has been disputed as a misnomer due to some nuances (Cropley & Kahl, 1983), such as whether DE or DL denotes both "teaching as well as learning" (Moore & Kearsley, 2012, p. 2). Some terminologies are commonly understood as synonymous with DE. For example, 'e-learning' and 'online learning' are technically the computer-based sub-type of DE, and should be precisely identified as hyponyms instead (Moore & Anderson, 2003). In a similar vein, telecollaboration is a separate subfield of computer-mediated communication (CMC) (Helm, 2015).

As a diverse field of study, multiple terminologies have arisen from the variation of researchers' interests and specialisation (Arkorful & Abaidoo, 2015). For instance, in a review of terminologies related to e-learning and DE, 23 concepts related to digital learning were identified, such as 'online learning', 'virtual learning' and 'm-learning' (Aparicio et al., 2016). In another literature review, 46 definitions were identified from literature published between 1988 and 2018 (Singh & Thurman, 2019). All in all, the diversity and indiscrimination of terminologies might confound the study and practice of DE.

2.1.1.4 Reconciling the inconsistencies

2.1.1.4.1 DE as an umbrella term

The inconsistencies of the definitions are rooted in the divergent preconceptions of the nature and purposes of DE. However, the inconsistencies are not necessarily antithetical or discordant, and the definitional dichotomy might be resolved by a heterogeneous conceptualisation of DE. Instead of homogenising one set of definitions and dispensing with inconsistent criteria, multiple contrasting definitions could be conflated in a broader umbrella of DE conceptualisation, which may lend itself to accounting for the complexity and diversity of pedagogical approaches, technologies and educational contexts (Johnston, 2020; Keegan, 1996). This inclusive approach to mapping the boundary of DE has been echoed by Garrison and Shale (1987), who claimed that a restrictive set of criteria might "result in too narrow view of distance education" (p. 7).

The epithet of "umbrella term" suggests that DE is a generic and diverse concept. In addition to the common criteria that delineate the essential qualities of DE, it is evident that not all definitions are universally applicable to all forms of DE, as inconsistent criteria are represented in definitions originated from different contexts, stages of educational technology and perspectives regarding the role of DE in relation to CI. The multipronged and integrative nature of DE necessitates an umbrella conceptualisation that is generalisable to a wide variety of evolving DE pedagogies (Anderson & Dron, 2011), and moving away from any specific definition to a more holistic, representative and rigorous understanding of DE.

In view of widespread opinions of terminological variety and a need for standardisation, this paper undertakes a comprehensive review and clarification of concepts that are analogous and relevant to DE. By surveying and clarifying common definitions of related, collocated and synonymous terminologies (refer to 'Appendix 3: Related terminologies of DE' for a full glossary and complete definitions), concepts that reasonably fulfil the definitional criteria in the foregoing section are compiled and grouped under the rubric of

DE, which provides the parameters and reference point for reviewing research in this systematic review.

2.1.1.4.2 Blended mode of DE

By and large, there remains a lack of consensus on the nature of DE as being modelled on or independent from CI. The contrasting perspectives of DE are both espoused but for different reasons. Modelling CI through synchronous instruction is attributable to certain learning benefits associated with physical and temporal presence, such as better interaction and community (Howard, 2009); however, the shortcomings of physical constraints, scheduling and higher costs are impediments to the delivery of education on a wider scale (Sadeghi, 2019). Considering the merits and limitations of both approaches, proponents argue that adopting both synchronous and asynchronous modes of DE could the 'best of both worlds', which leverage on educational technology to achieve the benefits of traditional CI, whilst overcoming the physical and temporal limitations (Ke & Xie 2009; Lawson 2007), and enjoying greater cost-effectiveness than CI in which the "costs are predominantly dependent upon student enrolment and the fixed costs of course development and delivery" (Cukier, 1997, p. 138). This is corroborated by the findings of empirical literature comparing CI with DE, denoting "media may transform the learning experience in ways that are unanticipated and not regularly available in face-to-face instructional situations" (Bernard et al., 2004, p. 4). In opposition to the notion of replicating CI, DE and the use of educational technology have even been considered the model for improving and modifying traditional CI pedagogies (Brooks, 1997; Stone & Perumean-Chaney, 2011).

In both research and practice, DE is typically conducted in the form of blended learning, amalgamating various modes, delivery methods, technologies and pedagogical approaches (Adams, 2013; Bernards et al., 2014; Caner, 2012; Driscoll & Carliner, 2005), in order to produce positive outcomes and cater for a wide range of contexts and learning purposes (Boyle, et al., 2003; Driscoll, 2002). Blended learning might combine DE with CI (Bonk & Graham, 2006; Garrison & Vaughan, 2008; Littlejohn & Pegler, 2007;

Stacey & Gerbic, 2009; Thompson & Irele, 2003; Watson, 2008), mixing various kinds of educational technology along side with or supplanting traditional face-to-face teaching, such as blending text-based asynchronous DE with CI (Garrison & Kanuka, 2004). Although arguments vacillate between the preferred modes of DE (e.g. Hamilton & Cherniavsky, 2006; Miller & Webster, 1997; Oztok et al., 2013; Wang & Wang, 2020), synchronous and asynchronous instructions are not mutually exclusive, and their combination is extensively utilised and researched across the teaching of different subjects (e.g. Power, 2008; Ramo et al., 2020).

According to Berge (1998), "both synchronous and asynchronous modes of communication are important web-based tools in teaching and learning" (p. 75), and thus advocated a multimodal approach in blended learning. The design and delivery of DE involves striking an optimal balance between the two approaches that is complementary and conducive to the learning outcome, thereby creating "the effective integration, fusion even, of face-to-face and online learning depending on the educational need and purpose" (Garrison, 2009, p. 200). Various technological tools could also be combined. For example, 'blended mobile applications' combine mobile technologies with other digital devices (Elaish et al., 2017), and massive open online course (MOOC) includes lecture recordings, digitalised textbooks, and web-based activities and exercises (Dhamdhere & Danver, 2016a). Multimodal learning, where learning content is presented and expressed in visual, aural and written modes (Sorensen, 2016), could enhance learning outcome by combining multiple modes of content (Meltem, 2015). In sum, the all-encompassing conceptualisation of the blended mode in DE is not only a reconciliation of inconsistencies in the field, but might amount to greater flexibility for which DE could take shape.

2.2 What are the categorisations of DE?

From the critical review of DE definitions, it is plausible that the wide-ranging elements of DE could be encapsulated coherently according to three categories of synchrony: asynchronous, synchronous and blended modes. The tripartite categorisation of

synchrony is widely adopted in literature (e.g. Bernard et al., 2009; Gabriel, 2004; Holden & Westfall, 2006; Johnson, 2006; Lock, 2002; Martin et al., 2017; Mahoney & Hall, 2020; McPherson & Bacow, 2015; Roblyer et al., 2007). To further justify this categorisation, this section explicates how the various media and technology, pedagogy and philosophical perspectives are embodied by the synchronous, asynchronous and blended modes of DE.

2.2.1 Media and technology

One of the common criteria of DE definitions is the use of media and technology, which are defined as the means and tools of communication between teachers and learners (e.g. Appana, 2008; Bernard et al., 2004; Bruder, 1989; Delling, 1966; Garrison & Shale, 1987; Greenberg, 1998; Keegan, 1996; Moore, 1973; Moore & Kearsley, 1996, 2012). The development of DE is understood as "an ever-changing process which is altered in response to the role of technology in society at large" (Ely, 1970, p. 81). Dating back to 1880s, DE has evolved over several generations of development, as progressive advancement of media and technology have transformed DE practices from predominantly asynchronous in the early generations of postal, correspondence and televised courses, to the emergence of synchronous communication when internet-based real-time technology became technically feasible and prevalent (refer to 'Appendix 4: Generations, synchrony and media and technology' for a comprehensive description of literature and empirical studies of DE generations, media and technology and synchrony). Subsequently, with the advent of social networking and media applications (Web 2.0) (Moore & Kearsley, 2012), increasingly varied and interactive forms of blended instructions have become the predominant model of DE (Bernard et al., 2004; Taylor, 2001). It is noteworthy that state-of-the-arts media and technology of the recent generations do not necessarily supplant those of the previous generations, but are rather adding to the enlarging ensemble in the field. For instance, earlier media and technology such as email, multimedia and CALL are widely deployed in contemporary DE. At present, media and technology could be largely categorised as asynchronous, synchronous, and the blending of the two synchronies.

2.3.2 Philosophy and pedagogy

To conceptualise the design of DE, it is necessary to understand the nature of media and technology (i.e. synchrony) and the underlying philosophy and pedagogy (Harasim et al. 1995). Media and technology should be implemented in conjunction with "a wide variety of methods, approaches or pedagogical philosophies" (Garett, 1991, p. 75). As media and technology represent the tools of DE, philosophy constitutes the underlying purposes and beliefs of education (Noddings, 1995), and pedagogy prescribes the design and approach that dictate the implementation of DE (Anderson & Dron, 2011). Without considering instructional philosophy and pedagogy, media and technology are merely channels for delivering information (Ascough, 2002; Cobb, 1994b).

Asynchronous and synchronous modes of DE are rooted in different instructional philosophies and pedagogies, which guide the design and application of DE. One of the dichotomies is whether DE should be designed for the individual study of independent learners, or group-based learning that features social interaction and collaboration (Daniel & Marquis, 1979; Garrison, 1985; Holmberg, 1995; Rumble, 1989). This extends to the question of whether communication should be asymmetrical, namely unilaterally passed to learners, or symmetrically designed for two-way interaction between teachers and learners, or among learners (Holden & Westfall, 2006). The asynchronous mode of DE may rely on asymmetrical designs, such as recorded lectures, and digital resources for self-study, which diverge from the synchronous mode, in which real-time chatrooms and videoconferencing allow learners to interact with teachers and classmates.

The more teacher-directed orientation of the synchronous mode (Hanna, 2003) contrasts with the philosophy of learner-directedness in the asynchronous mode of DE. In asynchronous DE, the emphasis is on self-directed learning (Keegan, 1996) and learner control (Garrison & Baynton, 1987); instructors are therefore facilitators of student learning, rather than actively imparting knowledge to the class (Perkins, 1999), and learners are endowed with more freedom to set their learning goals (Walhaus, 2000).

Self-directed learning may correspond with correspondence studies and CALL that are primarily designed for individual study, and would therefore be more suitable for learners who are self-regulated and self-directed (Carr-Chellman et al., 2000; Moore, 1989; Moore and Kearsley 1996; Simonson 1999; Lamb, 2000), and by extension, adult learners who are self-controlled and motivated (Knowles, 1968, 1975, 1980, 1984, 1989, 2014; Knowles et al., 2005). With prior learning experience and an independent self-concept, adult learners are more suited to the construction of knowledge in self-directed learning (SDL) (Merriam, 2001).

Pedagogically, social constructivism and collaborative learning could be embedded in both asynchronous and synchronous modes (Johnson & Johnson, 1996) but in different ways. Social constructivist pedagogy is based on the tenet that learning takes place when knowledge is constructed via social interaction (Bruner, 1990; Dewey, 1933; Piaget, 1970; Vygotsky, 1978), thus underscoring the role of social context and collaborative learning (Taskiran, 2019). In the context of DE, media and technology and instructional design should facilitate multiple means of social interaction that are conductive to knowledge construction (Adams & Burns, 1999), and electronic communities are formed as the social context for collaborative learning (Dede, 1996a; Odasz, 1994). In the asynchronous mode, examples may include social media and peer learning (Rheingold, 2012), blogging (Deters et al., 2010; Sun & Chang, 2012), wikis (Zheng et al., 2015) and threaded discussions (Ioannou & Artino, 2009), which involve learners' contribution, authorship of content and learning accountability (Du & Wagner, 2007). In the synchronous mode, collaborative learning may occur via chatrooms and videoconferencing. By blending asynchronous and synchronous modes, social construction of knowledge and collaborative learning may take place in hybrid forms of synchrony, including gamifications, mobile collaborative language learning, and web-based cooperative activities (Bates, 1995; Harasim et al., 1995; Kukulska-Hulme & Viberg, 2018; Lin & Lin, 2019; Malikowski, 1998).

2.3 What are the current findings of DE effectiveness?

The cardinal question of this study is to assess the effectiveness of DE. Within the scope of definitional criteria that constitute DE, this section reviews the general body of knowledge pertaining to the extent synchrony and moderating variable are associated with the effectiveness of DE, and the major types of outcomes measured in empirical studies.

2.3.1 Meta-analyses

From DE studies that compared media and technology according to categories of synchrony, there is a clear pattern that distinguishes the outcomes of asynchronous, synchronous and blended types of media and technology, which are exhibited in the summary of findings in meta-analyses below.

Table 2.3 Meta-analyses of SLL/FLL and multidisciplinary studies of DE

Author(s) (year)	Number of studies (period)	Subjects	Measures	Effective mode*		
				A	S	B
Bernard et al. (2004)	232 (1985-2002)	Multidisciplinary	Learner achievement	✔		
Bernard et al. (2009)	74 (1985-2006)	Multidisciplinary	Perception and attitude	✔		
Lin et al. (2013)	10 (1990-2012)	SLL/FLL	L2 learning outcome		✔	
Mahmud (2018)	59 (1988-2015)	SLL/FLL	L2 learning outcome, perception and attitude			✔
Ebner & Gegenfurtner (2019)	5 (2012-2015)	Multidisciplinary	Learning outcome; perception and attitude		✔	

**A = asynchronous; S = synchronous; B = blended*

2.3.2 Moderating variables

While the synchrony of DE is arguably an influential factor of effectiveness, there is also a plethora of moderating variables that might influence the effect of the independent variable (i.e. synchrony of DE) on the dependent variable (i.e. effectiveness of DE) (Rogers & Andrea Révész, 2020). According to empirical studies, the common variables that affect DE effectiveness include the nature and extent of interaction (e.g. Abrami et al., 2011; Cunningham, 2016; Jung et al., 2002; Moore, 1989; Picciano, 2002; Rourke & Kanuka, 2009) and collaboration (e.g. So & Brush, 2008; Swan, 2001); cognitive presence (Akyol & Garrison, 2011a); types of tasks (Guth & Helm, 2011; Hauck & Youngs, 2008); authenticity of learning activities (Herrington et al., 2010) and testing (Laurier, 2000); learners' reading and writing proficiency (Stern, 2004); preference and learning styles (Kucuk et al., 2010; Tucker, 2001); technical resources (e.g. bandwidth, connectivity and support) (Miller & King, 2003); types of devices (Hao et al., 2021); time zones in synchronous instructions (Carr-Chellman et al., 2000); learners' proactiveness, maturity and sense of responsibility (Moore & Kearsley 1996; Muirhead, 2000; Palloff & Pratt, 1999; Souder, 1993); self-esteem (Tayebinik & Marlia, 2012); ability to construct knowledge socially (cognitive and social presence) (Akyol & Garrison, 2011a), and cultural practices (O'Dowd, 2007a, 2007b, 2012; Thorne, 2003; Uzum et al., 2019).

2.3.3 Effectiveness of DE in SLL/FLL

There is a vast amount of literature in the overall field of DE, and the sheer volume of literature connected to SLL/FLL in DE is also voluminous. According to literature summarising the effects of DE on SLL/FLL (AbuSeileek, 2012; Beauvois, 1997; Lee, 2011) and a synthesis of research findings since 2000 (refer to 'Appendix 5: Summary of studies in DE of SLL/FLL since 2000'), there are four types of variables:

- L2 learning outcomes
- Perception and attitude of teachers and learners

- Motivation of learners
- Emotion of learners

Based of the findings of SLL/FLL studies, DE evidently has an impact on all types of SF/FL skills in diverse L2s (e.g. Arabic, Chinese, English, French, German, Spanish), and the findings generally conform to the four groups of variables above. However, there is a lack of systematic and theoretical explanations for the relationships among media and technology, L2 skills, SLL/FLL context, languages, variables and effects. In this connection, the ensuing section explains how the transactional distance theory (TDT) provides a coherent framework that accounts for the effectiveness of DE.

2.4 How to theorise the effectiveness of DE?

2.4.1 The role of a global DE theory

A robust theory of DE has the invaluable role of "guiding the complex practice of a rational process such as teaching and learning at a distance" (Garrison, 2000, p. 3). The proposal of an all-embracing theory entails "exploring theories and generalisations that have been seen to have practical application" (Perraton, 1987, p. 3). There are compelling justifications that transactional distance theory (TDT) qualifies as a global theory that converges the theories and practices in the field (Gokool-Ramdoo, 2008), and has been validated by empirical evidence and upon which further scholarships are established.

2.4.2 Transactional distance theory (TDT)

2.4.2.1 Background

TDT is considered the magnum opus of Michael Moore (1972, 1973), whose seminal work originated from discriminating conventional institutions (i.e. CI) from non-traditional methods of education (later known as DE), which is characterised by independence of learning, teaching and learner autonomy. The concept of transactional

distance (TD) is a pedagogical rather than a physical construct, which could be defined as the psychological distance between learners and the teacher, creating barriers that prohibit learners to actively engage in DE (Zhang, 2003).

2.4.2.2 Development

A profusion of theoretical development, empirical research and applications have been built on the central ideas to understand, measure and reduce TD in relation to the study of DE design and effectiveness. TDT is widely applied as the 'conceptual lens' (Falloon, 2011) that could guide the research of DE (Bernath & Vidal, 2007), synthesise the perspectives, theories, and dynamic inter-relationships of variables (Garrison, 2000; Gokool-Ramdoo, 2008; Peters, 2007), and constitute the long-established foundation for further theoretical development (e.g. Giossos et al., 2009; Saba, 1988, 2003, 2008; Saba & Shearer, 1994; Vasiloudis et al., 2015) and empirical investigations (e.g. Bischoff et al., 1996; Bunker et al., 1996; Chen, 2001a, 2001b; Chen & Willits, 1998; Don, 2005; Falloon, 2011; Park, 2011). The validity of TD has also been affirmed in literature (Goel et al., 2012; Saba & Shearer, 1994).

2.4.2.3 Variables

With five decades of development, TDT has undergone continuous revisions and subsequently formalised as a model that conceptualises TD as the function of the three variables (Moore, 1972, 1973, 1989, 1990a, 1990b, 1990c, 1993, 1997a, 1997b, 2007):

1) 'Structure' is the degree of rigidity (or flexibility) in the structure of the DE course, which measures the level of responsiveness to the individual needs of learners;
2) 'Dialogue' refers to the degree of interaction between the learners, instructor and content; and
3) 'Autonomy' is the degree to which learners are enabled to make decisions that affect the design and delivery of their own learning.

2.4.2.4 Continuum

Moore (1993) theorised TD as a continuum that reflects various degrees of dialogue and structure. Theoretically, dialogue and structure are inversely related (Dron et al., 2004; Huang et al., 2016; Saba, 1988; Saba & Shearer, 1994). By the same token, a proportionally higher autonomy is required to counterbalance an increasing level of TD, whereby a more autonomous learner could adapt to a DE course with limited interaction with the teacher or peers (low dialogue) and a course design that is rigid and insensitive to the learners' needs (high structure). Autonomous learners could also affect the level of knowledge and idea exchange, thus increasing dialogue and the flexibility of course structure (Moore, 1993). The relationship of the three variables is illustrated below (Moore, 2018; Shearer, 2009).

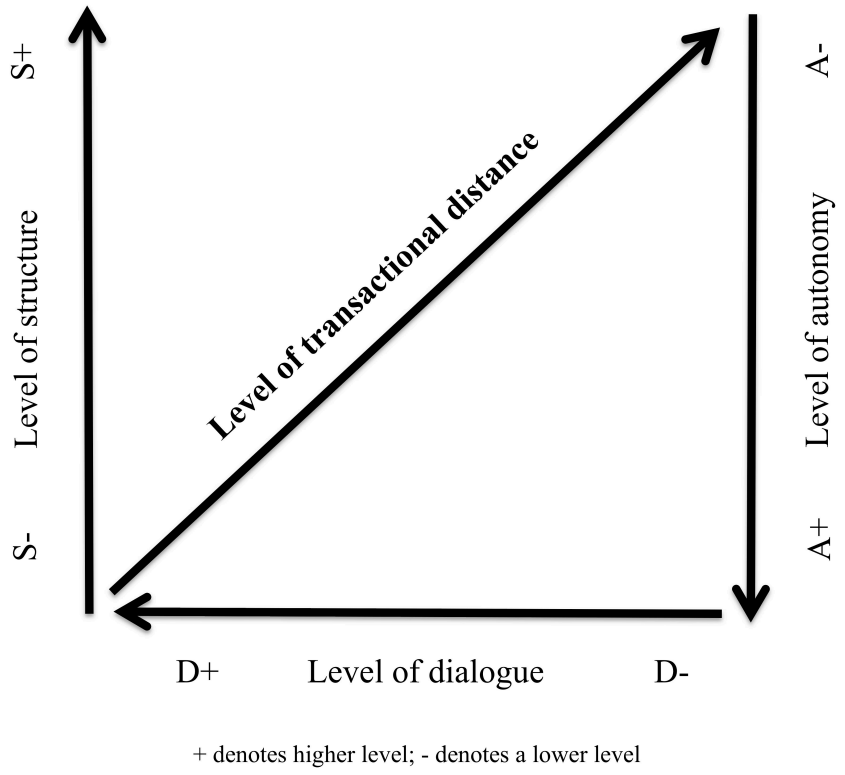


Figure 2.2 Relations of structure, dialogue and autonomy in TD

2.4.2.5 Convergence of theories and concepts

TDT qualifies as a global theory due to the convergence of the three variables with major theories and concepts of DE. Firstly, the variable of structure, or the level of flexibility embedded in the design of a DE course, is connected to the theory of constructivism (Duffy & Jonassen, 1991), which concerns how learners are guided to construct the acquisition and interpretation of content. As asynchronous instructions do not involve real-time dialogue, the structure of DE could be arranged to facilitate collaborative learning through computer-mediated activities (Garrison & Cleveland, 2005), such as wikis, threaded discussions (Jaffee, 1997) and weblogs (blogs) (Campbell, 2003). Structure is also congruent with the community of inquiry (CoI) model, which suggests that DE takes place through teachers who monitor and regulate learning, also known as teaching presence (Akyol & Garrison, 2011b; Garrison et al., 2020). The availability of scaffolding (Vygotsky, 1978), namely the support that a teacher provides to bolster learners in DE, is also related to the level of structure and dialogue (Sharma & Hannafin, 2004).

Earlier scholarships that emphasise on the social construction of knowledge and educational experience, such as Dewey's (1934, 1938) theory of social constructivism, antedate the variable of dialogue in TDT. Dialogue also coincides with other DE concepts that are oriented towards the social and interactive aspects of learning, including Holmberg's (1989) concept of 'guided didactic conversation', community of inquiry (CoI) (Garrison et al., 2000, 2010), and collaborative learning (Hiltz et al., 2000)

The variable of autonomy corresponds closely to the self-determination theory (Ryan & Deci, 2000). The parallel of self-determination theory and autonomy could be exemplified by gamification (Mekler et al. 2017; Rigby & Ryan 2011; Sailer et al. 2017a), which is an approach of DE that is chiefly directed by learners who are intrinsically motivated in the learning process (Ryan & Deci, 2002). Learner autonomy is also rooted in the notions of self-regulated learning (Andrade & Bunker, 2009; Oxford, 1999, 2011,

2016) and constructivism (Cole, 1992; Duc, 2012; Garrison, 1993b; Valasidou et al., 2005; Yakimovicz & Murphy, 1995), as autonomous learners manage their learning progress and relate their personal goals and experiences to actively engage in knowledge construction.

3. Methodology

3.1 Aim

Having reviewed the definitions of DE, categorisation of DE, measurements and variables of effectiveness, and an all-encompassing 'global' theory, there are a number of areas that warrant further examination in the field of DE, and SLL/FLL in particular.

To provide an overall and reliable understanding of the effectiveness of SLL/FLL in DE, a systematic review was carried out that endeavoured to "identify, appraise and synthesize all relevant studies" (Petticrew & Roberts, 2006, p. 9). Empirical evidence was evaluated based on the categorisation of synchrony and within the theoretical framework of TDT.

3.2 Research questions

This study attempted to accomplish the aforesaid aim and explore the pertinent issues by addressing three research questions:

1. To what extent are different DE modes (i.e. asynchronous, synchronous and blended) effective in SLL/FLL?
2. To what extent are TD levels different across the DE modes?
3. What is the relationship between the levels of TD and effectiveness of the DE modes?

3.3 Hypotheses

Based on the literature review, the following hypotheses have been formulated in relation to the research questions:

1. Owing to the difference in media and technology, philosophy and pedagogical approach, the magnitude and types of outcome are likely to vary according to the synchrony of instruction (i.e. DE categories / modes).
2. TD levels in each DE mode could be different depending on the instructional design and implementation of SLL/FLL. Since the blended mode is generally favoured in the current generation of DE and might demonstrate the benefits of both asynchronous and synchronous modes, and the blended mode is more likely to yield more positive outcomes.
3. Based on the assumption of TDT, TD is a barrier to learning and is inversely correlated with the effectiveness of DE. A similar relationship is hypothesised to manifest in SLL/FLL.

3.4 Systematic review

The volume of research studies in the field of SLL/FLL in DE is prodigious, and moreover, the concept is multifaceted and not easily assessed without "a common meaning or set of objective criteria" (Garrison, 1993a, p. 10). In light of a possible gap in understanding synchrony of DE within the framework of TDT, this study extracted relevant empirical studies from the extant body of knowledge, and made objective assessment of the findings from the included studies. Unless a systematic and transparent process of selection and critique is applied, the sampling of studies could be prone to biases (Macaro, 2020). To minimise selection bias, this study had followed the rigorous method of systematic reviews, and synthesised the findings of studies that were included based on a prescribed set of clearly described and replicable procedures.

3.5 Eligibility criteria

To accomplish the aims of the study and address the research questions, this systematic review applied inclusion and exclusion criteria in the process of screening studies. The eligibility criteria and rationales in Table 3.1 form the blueprint of the inclusion process.

Table 3.1 Eligibility criteria and rationales

Dimension	Inclusion	Exclusion	Rationale
Type of literature	Empirical studies and primary research	Systematic review, meta-analyses, secondary research	The purpose of conducting a systematic review is to synthesise empirical findings and not the opinions and theories (Macaro, 2020).
Definitions of DE	Fulfils the definitions of DE and/or correspond with the related and synonymous terminologies (refer to 'Appendix 3: Related terminology of distance education')	Studies that are predominantly based on CI rather than media and technology; situated in contexts or based on practices that fail to qualify the standardised definitions	Due to the elusiveness and inconsistencies in understanding, studies should conform to the standardised definitions synthesised in the present study so as to preclude the inclusion of irrelevant studies. Moreover, comparison of CI with DE is extraneous to the research questions. In view of the diversity of educational approaches, such as mixing CI with DE, the included studies should have classified DE based on the definitions and terminologies detailed in '2.1.1 Definitions of DE' and '2.1.2 Related and synonymous terminologies' of literature review.

Dimension	Inclusion	Exclusion	Rationale
Focus of DE types	Examining more than one DE category in SLL/FLL	None or one type of DE category; not principally connected to SLL/FLL	This study deliberately compares and connects different DE categories, thus entailing research studies that specifically investigate at least two DE categories in SLL/FLL.
Article types	Peer-reviewed articles that are published in academic journals	Unpublished doctoral theses, book articles, conference papers and government reports	This is to maintain a reasonable level of quality in the pool of included articles, which should have satisfied acceptable standards of validation and credibility. Although unpublished doctoral theses may contain underreported null results (Macaro et al., 2017), narrowing the selection to peer-reviewed articles is justifiable on the ground of ensuring the depth and quality of analysis under the constraints of time and human resources.

Dimension	Inclusion	Exclusion	Rationale
Year of publication	Studies of all periods	N/A	Media and technology adopted in previous generations are still applied. Coverage of all timeframe would therefore increase the validity and representativeness of findings. Moreover, the narrower focus of SLL/FLL is estimated to result in a manageable number of studies for which due attention could be given.
Language of article	All languages	N/A	This is to increase the representativeness and validity of the synthesised findings.

Dimension	Inclusion	Exclusion	Rationale
Subject types	Adults	Children and subjects with special needs	DE is generally applied in the context of andragogy (Pratt, 1988, 1993; Rossman, 2000), namely for adult students with self-directed learning (Knowles, 1968). In fact, the majority of previous studies were conducted with adult subjects. Therefore, the general adult population is purposely focused in this study. Confounding variables stemming from different learning and developmental backgrounds are therefore controlled. Furthermore, reviews of SLL/FLL indicate that the majority of studies have focused on students in higher education settings (Lin, & Warschauer, 2015).
L2 and settings	Any language and institutional setting	First language learning and non-institutional (e.g. entirely self-study) settings	A broad range of dimensions is covered to strengthen the validity of the review (Macaro, 2020), which intends to comprehensively assess DE in SLL/FLL.

Dimension	Inclusion	Exclusion	Rationale
Content of article and contextual information of study	Clearly written abstract, research questions, aims, literature review, methodology and findings, with detailed contextual information of study	Unclear or insufficient details in the article	Clarity of the article and detailed descriptions of contextual background and methodology are required to assess the quality of the study, and evaluate the variables of TDT (i.e. structure, dialogue, autonomy) so as to deduce the overall level of TD.
Quality of research	Studies with a quality rating of 'medium' or 'high' according to the weight of evidence (WOE) measurement (refer to 'Appendix 6: Quality assessment form and parameters of rating')	Studies with a quality rating of 'low' or with insufficient information for quality rating	• Improving the overall quality of findings in the synthesis • The reviewer applies a set of designated parameters for rating the quality of studies as low, medium and high. • Details and reasons for the exclusion of studies are documented in 'Appendix 46: Summary of excluded studies (during in-depth review)'

3.6 Systematic mapping

According to Macaro (2020), a systematic map is a table containing succinct details of studies under review. The table used in this study is a modification of the systematic map devised by Macaro, Handley and Walter (2012), who also investigated the effectiveness of media and technology by covering a range of computer assisted language learning (CALL) in English as a L2, and with a focus on primary and secondary education. Amongst a very limited number of systematic reviews of SLL/FLL in DE, the other research areas were largely focused on particular forms of DE instruction and factors unrelated to effectiveness (e.g. Lambert, 2020; Persson & Nouri, 2018). On the reasonable ground that the present study is comparable to the aforesaid systematic review (Macaro et al., 2012), its systematic map is understandably applicable to meeting the research objectives in question. Furthermore, the template collects information of moderator variables (e.g. country, educational setting, L1), which could potentially affect the results of the studies being examined (Petticrew & Roberts, 2006). Figure 3.2 is the template of the systematic map (refer to 'Appendix 44: Systematic mapping of included studies').

Author, Year and title	SLL/ FLL	Setting and Sample	Media and technology (DE mode)	Variable	Methodology	Measurement and analysis	WOE

Figure 3.2 Template of the systematic map

3.7 Search strategy

The risk of biases, such as the tendency to select accessible research based on convenience, could be minimised by an explicit search strategy (Gough et al., 2017). This systematic review followed the guidelines and practices of relevant systematic reviews (Macaro et al., 2012; 2017; Macaro, 2020) by incorporating transparent procedures, exhaustive and reliable searching, reduction of reviewer bias, and the synthesis of

empirical findings (Macaro et al., 2017). There were adaptations to entertain the circumstances of this study, including the use of a primary reviewer and two checkers, and excluding doctoral theses in the sampling and reviewing process. These adaptations are justified in the following sub-sections.

3.7.1 Databases

The databases used for performing the electronic search are commonly used in the fields of second language acquisition (SLA) and applied linguistics (Macaro, 2020), and were also selected in the comparable systematic review of SLL/FLL in DE (Macaro et al., 2012). The list of databases is as follows:

- Education Resources Information Center (EBSCO)
- Linguistics and Language Behavior Abstracts (LLBA)
- ProQuest Dissertations and Theses
- Social Sciences Citation Index (SSCI)
- SCOPUS

3.7.2 Keywords

The databases were accessed through the Bodleian Libraries, University of Oxford. A selective choice of keywords had been applied in an initial scan of articles that contained ‘distance education’, ‘asynchronous’ and ‘synchronous’ in the text, which produced an exceeding broad and unmanageable result in excess of 1000 articles. It was presumed that for a loosely defined concept of DE, more keywords are needed (Macaro, 2020). The searches were also confined to the matching all keywords with the abstracts (denoted as *ab* preceding each keyword), as shown in Figure 3.3, so as to ensure that the concepts represented by the keywords are completely contained in the essential content of articles.

ab(synchronous) AND ab(asynchronous) AND ab(blended) AND ab(distance education) AND ab(distance learning) AND ab(language) AND ab(learning)

Figure 3.3 Initial string of keywords

However, tentative searches of extensive keywords that matched article abstracts had supplied a few or no results in the databases. As displayed in Table 3.2, a tentative search in December 2020 had resulted in meagrely 5 articles that matched all the keywords in the abstracts:

Table 3.2 Tentative searches

Date	Database	Number of articles
25/12/2020	Education Resources Information Center	1
25/12/2020	Linguistics and Language Behavior Abstracts (LLBA)	1
25/12/2020	ProQuest Dissertations and Theses	0
25/12/2020	Social Sciences Citation Index (SSCI)	0
25/12/2020	SCOPUS	4

A number of revisions had been made to iteratively refine the search results, so as to strike an optimal balance between inclusiveness and relevance. To avoid including articles of blended learning that denote the combination of CI and DE, the keyword ‘blended’ was excluded, as the hybrid forms of DE are implied by the keywords ‘synchronous’ and ‘asynchronous’. Since there are considerable synonyms of DE, the keywords ‘distance education’ was removed, in case relevant studies with other synonyms are inadvertently filtered out. With a more selective list of keywords, the refined search could broaden the scope of articles, thereby improving the overall representativeness of the research findings. The refined string of keywords is as follows:

ab(synchronous) AND ab(asynchronous) AND ab(language) AND ab(learning)

Figure 3.4 Finalised string of keywords

From a broader universe of studies, the reviewer winnowed down the selections by validating the eligibility and quality of the samples through systematic procedures and selection standards that have been designed to maximise the level of objectivity (expounded in the next sub-section).

3.8 Inter-rater and intra-rater reliability

The reliability of raters constitutes a key factor of the quality of systematic reviews (Macaro, 2020). Ideally, the potential of personal biases could be minimised by the involvement of multiple reviewers (Macaro et al., 2017). Notwithstanding the benefit of collective effort, the author of this paper was concurrently the primary reviewer, and the documentations and justifications of reviews were double checked by two teaching assistants at the Open University of Hong Kong. With over two years of experience tutoring multiple subjects (communication, business management and sport sciences) using asynchronous, synchronous and blended instructions in DE and CI, the two checkers were reasonably familiar with the topic of this study, and were interested in assisting in this project on a voluntary basis. This approach was adopted due to the pragmatic reason of unavailable time, monetary and human resources for a Master's level research, and was not expected to compromise the depth of analysis. The nature of the present study is exploratory and confined to a smaller subset of the broader field of DE, thus delimiting the scope of the study that is conceivably manageable for which due attention could be given to each article. Furthermore, as detailed in the later sub-sections, the methodology modelled the best practices of peer-reviewed articles, so as to maintain transparency and mitigate reviewer subjectivity, thereby reaching a level of stringency that approximates a formal systematic review (Petticrew & Roberts, 2006).

Intra-rater reliability has been established by two separate reviewing of studies, which revisited ambivalent judgements on the included articles. The two reviewing processes took place with an interval of four months (February and June 2021), so as to reduce the influence of earlier memory or impression of the initial review.

3.9 Inclusion process

The inclusion process involved three stages. In the initial stage of preliminary screening, the keywords were applied to the databases and produced results of the first trawl. The reviewer then removed the duplicated articles extracted from different databases. In the second stage, the reviewer undertook an in-depth examination and refined the pool of articles using the eligibility criteria in Table 3.1. Rayyan, an online tool designed for systematic reviews, was used to assess the eligibility of articles and make selection decisions (Ouzzani et al., 2016). Each article was rated on a three-tier classification of 'high', 'medium' and 'low' quality using parameters of the modelled systematic review (Macaro et al., 2012), which followed the EPPI-Centre approach (2017) of weighing the research evidence according to the level of trustworthiness, appropriateness and relevance. The related terminologies in literature review and appendices were also crosschecked to ascertain the relevance of studies. To further strengthen the rating of reliability, the trustworthiness of studies was evaluated based on the codification system of Gorard's 'sieve' (2014) for judging the believability of research (see 'Appendix 6: Quality assessment form and parameters of rating'). Furthermore, studies that adequately adopted a mixed research to triangulate qualitative and quantitative findings are more likely to improve validity (Bryman, 2015) and therefore received a higher weighing of evidence (WOE).

The third stage involved backward and forward citation tracking of the included articles. In forward citation tracking, the articles citing the sampled articles were identified; whereas in backward citation tracking, the articles extracted were drawn from the referenced list of the sampled articles (Card, 2012). The extracted articles were screened

to remove possible duplications, and scrutinised using the same procedure of in-depth review in the second stage. Performing backward and forward search would include the greater number of relevant studies that might fulfil the inclusion criteria of the review.

Figure 3.5 is a graphical illustration of the three-stage process for screening and forming the pool of included articles.

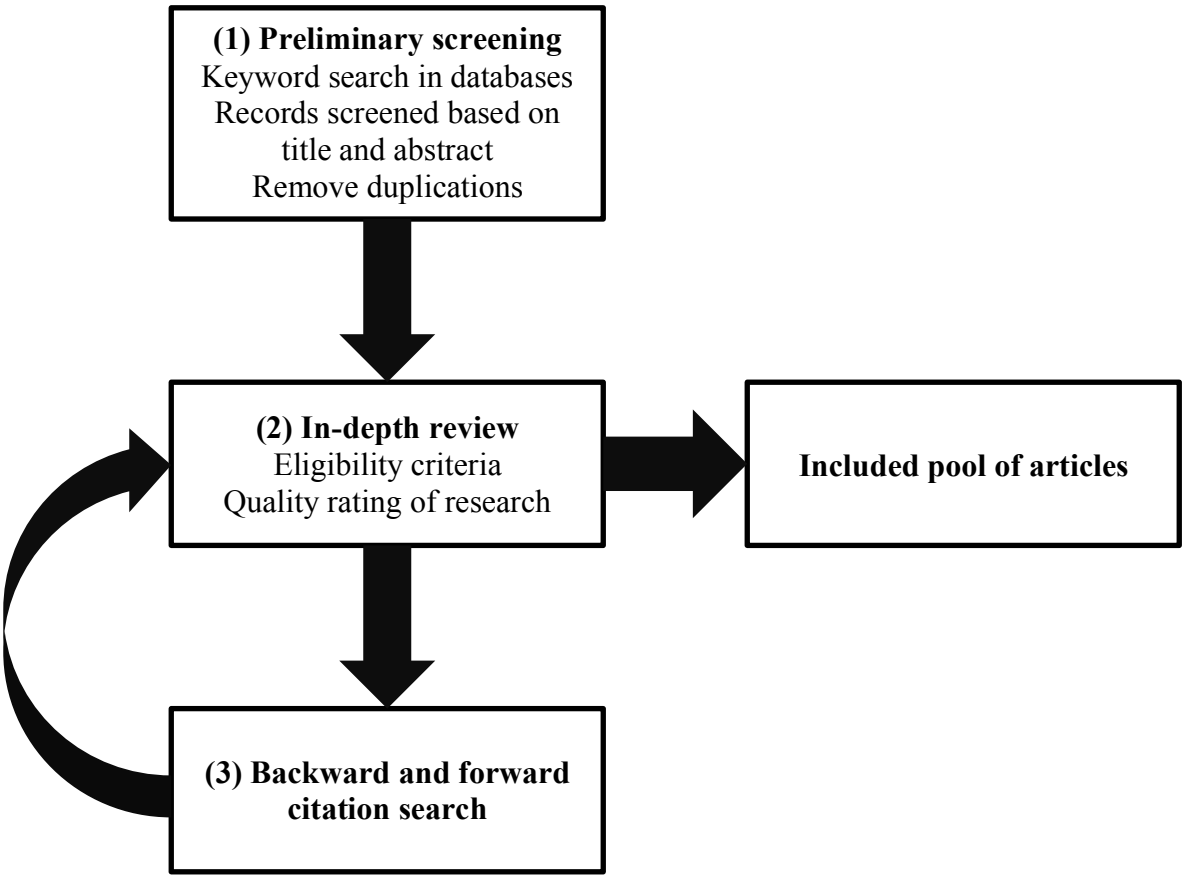


Figure 3.5 Stages of article inclusion

3.10 Record

With the permission of the supervisor of this study, the extraction grid of his co-authored systematic review (Rose et al., 2021) was adapted as a spreadsheet for recording the details of the articles included in the body of work (refer to 'Appendix 7: Data extraction form' for details).

3.11 Reviewing process

This systematic review is intended to be exhaustive, and therefore included peer-reviewed articles that were authored in any languages. In the event of including papers in foreign languages, the author would consult the respective language staff in the School of Education and Languages at the Open University of Hong Kong.

3.12 Assessment of TD levels

Upon finalising the pool of articles, the reviewer measured three components of the TDT (i.e. structure, dialogue and autonomy) based on the details of the background and methodology, and rated the variables' scores on a qualitative scale of 'no TD', 'low TD', 'average TD', and 'high TD'. These scores would then be consolidated into an aggregated measurement of TD for each study (refer to 'Appendix 8: Items for measuring transactional distance' (TD)). Measurements of TD were derived from the theoretical constructs of TDT and instruments in empirical studies of TD (Chen & Willits, 1999; Huang et al., 2015; Lane, 2017; Macaskill & Taylor, 2010; Paul et al., 2015; Zhang, 2003).

Colour coding was also used to distinguish the TD classifications in the reporting of results.

Classification	Numeric score of TD*	Colour code
Very low	1	
Low	1 to ≤1.5	
Low to medium	>1.5 to <2	
Medium	2	
Medium to high	>2 to <2.5	
High	≥2.5 to <3	
Very high	3	

**Score of TD = average score of individual variables: structure, dialogue and autonomy*

Figure 3.6 Classification of TD levels

Qualitative content analysis (QCA) (Selvi, 2020) was used as to interpret and infer the degree of TD from the articles. The reviewer interpreted the text by referencing the operationalised descriptions of TD and the constituent variables on the TD scale (Zhang, 2003; Paul et al., 2015). According to Zhang (2003), the original developer of the TD scale, TD could be defined as the "cognitive, emotional, social, cultural, and/or physical distances between learners and the other elements of their learning environments that prohibit active student engagement with learning" (p. 183), and operationalised as the "barriers to students' active engagement with learning in the online course environment." This study also enhanced the method of TD measurements by adopting empirically tested operationalisations from other TD studies (Huang et al., 2015; Lane, 2017).

4. Results

4.1 Flow of studies

Following the rigorous standards of Cochrane systematic reviews, this study includes the PRISMA diagram as a best practice approach to document the flow of studies (Stovold et al., 2014). The screening process has resulted in the inclusion of 31 studies.

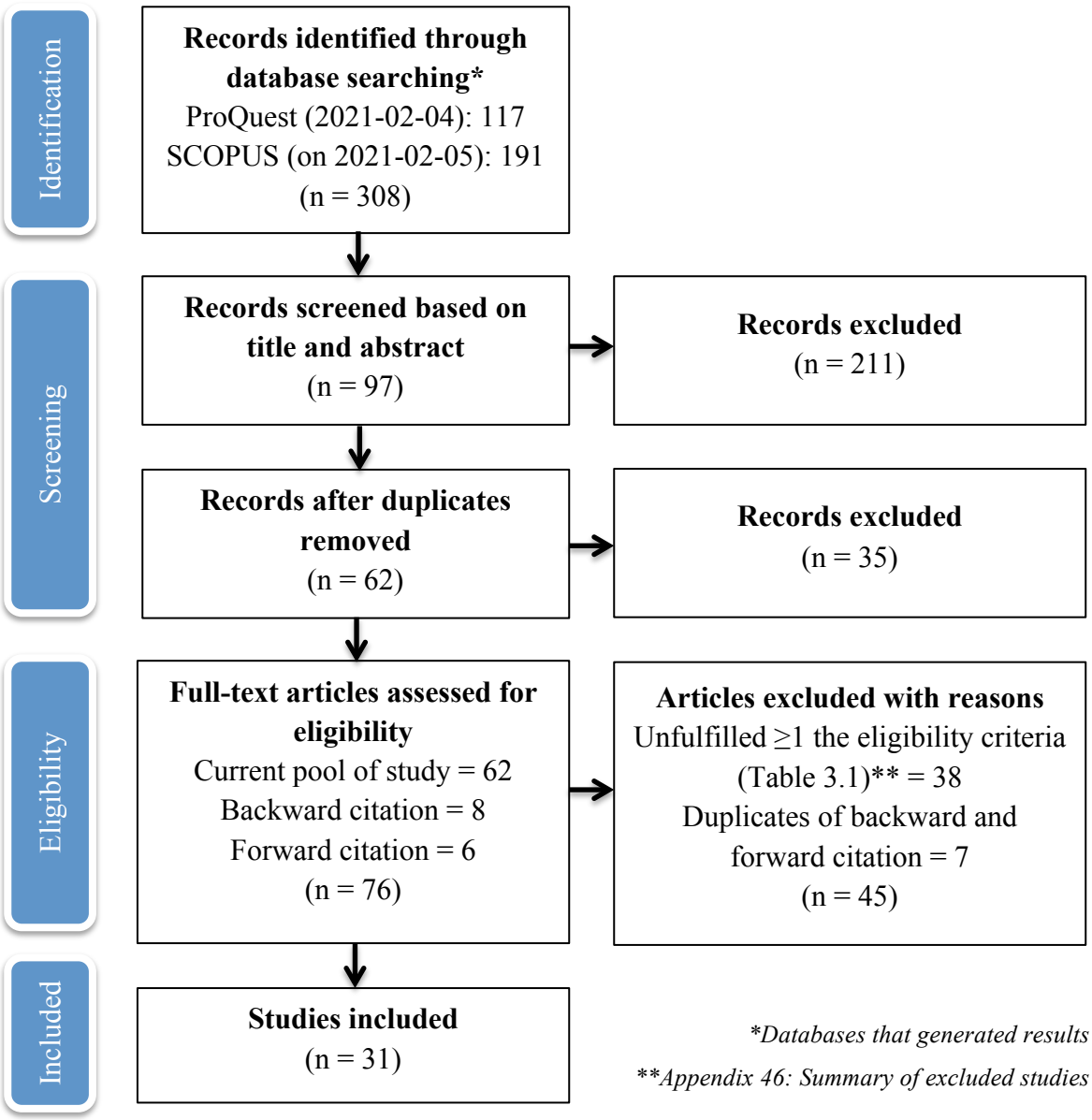


Figure 4.1 PRISMA study flow diagram

4.2 Overview of included studies

Table 4.1 presents an overview of the included studies (documented in Appendices 44 and 45).

Table 4.1 Summary of background information of included studies

Background information	**Summary**	**Most common category**
Number of Included studies	31	N/A
Years of publication	2000 – 2020	2015 – 2019, 2020 (52%)
Sample sizes	13 – 1,025 participants	Less than 50 (48%)
Length of studies	6 weeks – 2 years	1 term / semester (55%)
Research methods	Observational (cross-sectional and longitudinal), experimental and quasi-experimental	Cross-sectional (55%)
Types of data collection	Mixed, quantitative, and qualitative	Mixed (58%)
Number of L1s	16	English (22%)
Number of L2s	6	English (55%)
L2 levels of courses	Novice to advanced	Intermediate (29%)
L2 skills taught in the courses	General, speaking, writing, and vocabulary	General (42%)
Number of countries / regions	16	USA (37%)
Settings	University, pre-university, college, higher education, language institution	University (84%)
Participant types	Postgraduates, undergraduates, college students, adult learners	Undergraduates (68%)

4.3 Reliability of study inclusion

All data collection, analysis and reporting of results were verified independently by the two checkers, who had confirmed the accuracy of the results. In terms of measuring the levels of TD, the agreement rates of the reviewer and the two checkers were 90.3% and 93.5% respectively, with variations of not larger than a TD score of 0.5 in each instance of DE instruction. The reviewer and checkers discussed the reasons of judgement and came to a consensus. In view of a reasonably high level of agreement and unanimous conclusion in the subsequent discussion of slight variations, the overall level of inter-reliability could be deemed acceptable.

In the two reviewing processes took place with an interval of four months, there was no discrepancy and thus provably support intra-rater reliability.

4.4 Quality of included studies

Each study was evaluated based on its level of relevance, appropriateness, contribution and trustworthiness, resulting in an overall rating of weight of evidence (WOE). In accordance with the eligibility criterion of research quality, studies with a high or medium level of WOE were eligible for inclusion, and accounting for 84% and 16% of the included studies respectively (refer to 'Appendix 44: Systematic mapping of included studies' for further details).

Table 4.2 Weight of evidence (WOE) of the included studies

Level of WOE	**Number of studies**	**Percentage**
High	5	16%
Medium	26	84%
Total	31	100%

Studies assessed as having a low level of WOE or articles containing insufficient information were excluded. In addition, the studies were reviewed using the Effective

Public Health Practice Project (EPHPP) Instrument (1998) for assessing the trustworthiness, validity and relevance of quantitative studies, and the 10-question systematic review checklist (2018) from the Critical Appraisal Skills Programme (CASP) for qualitative studies. The results were compared with the WOE rating and no material inconsistency was observed.

Furthermore, as part of the eligibility criteria, the scope of study inclusion was limited to publications in peer-reviewed journals; hence experts in the field have evaluated the validity and reliability of the studies.

4.5 Research methodology

4.5.1 Research design

The WOE ratings substantiate the quality of research methodology in the included studies. According to Figure 4.2 (refer to Appendix 10 for further details), the included studies were conducted using various research methods, suggesting a reasonable level of representativeness of research approaches and findings.

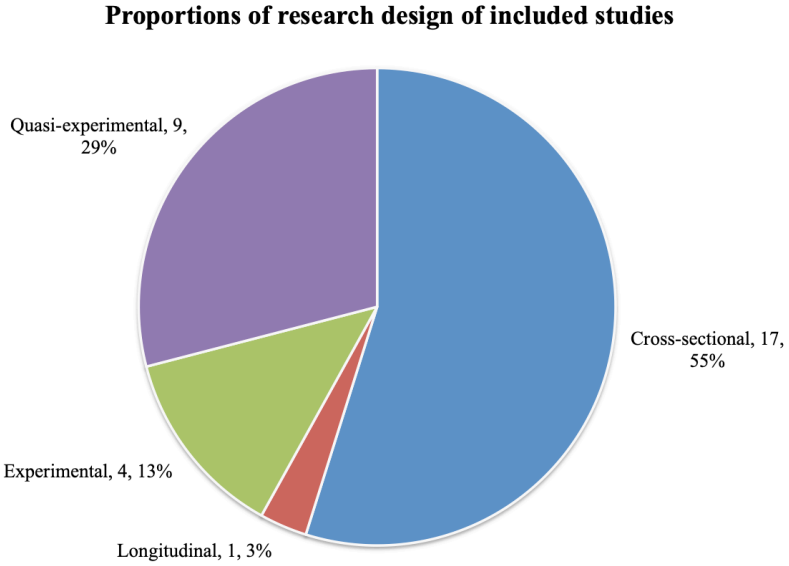


Figure 4.2 Proportions of research design of included studies

4.5.2 Data collection

According to Figure 4.3 (refer to Appendix 11 for further details), over half of the studies (58%) adopted the mixed method of data collection, using multiple sources of data type in the empirical investigations. The triangulation of quantitative with qualitative data in the majority of studies could have improved the validity and reliability of findings.

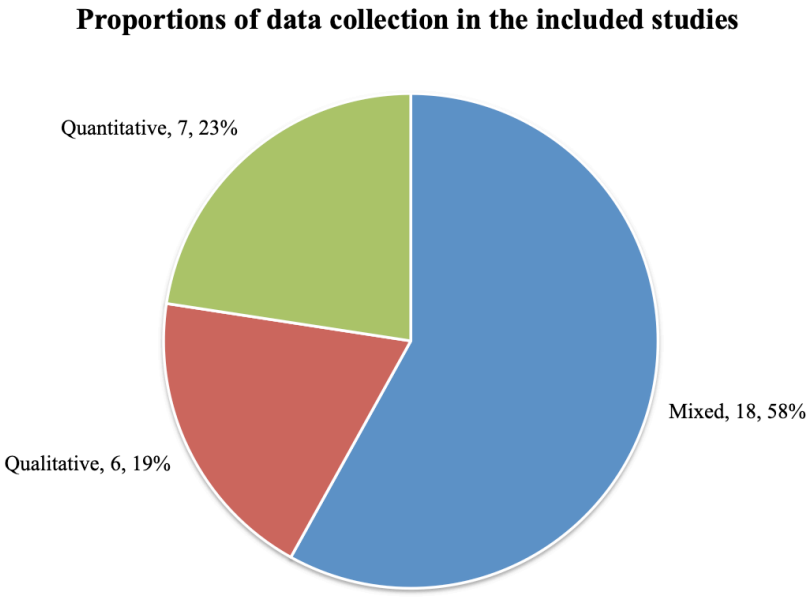


Figure 4.3 Proportions of data collection of included studies

4.5.3 Length of empirical investigation

Figure 4.4 (refer to Appendix 12 for further details) shows the lengths of empirical investigations in the included studies. The period of empirical investigations ranged from 6 weeks to 2 years. The findings obtained are based on reasonable lengths of observations and experiments, as around three quarters of the investigations were longer than 3 months.

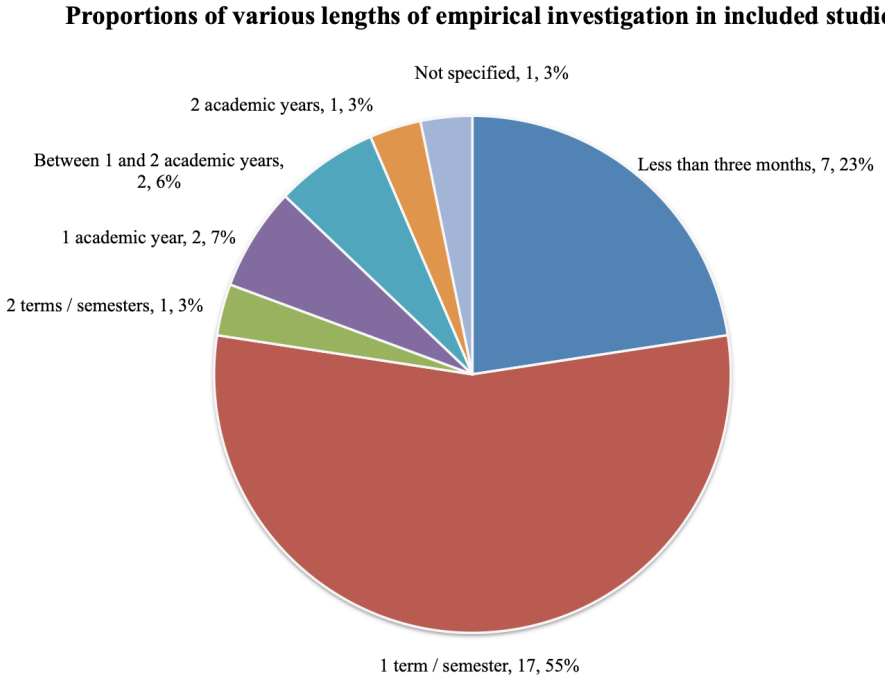


Figure 4.4 Proportions of various lengths of empirical investigation in included studies

4.6 Number and characteristics of included studies

4.6.1 Years of publication

The included studies were published between 2000 and 2020, with a median of 2015. Figure 4.5 presents the numbers of studies published in four 5-year periods and 2020. While the time of publication was not designated in the literature research process, the included studies were published in the two recent decades (refer to Appendix 13 for further details). There is a noticeably increasing trend of research into DE modes that fulfil the eligibility criteria of the present study.

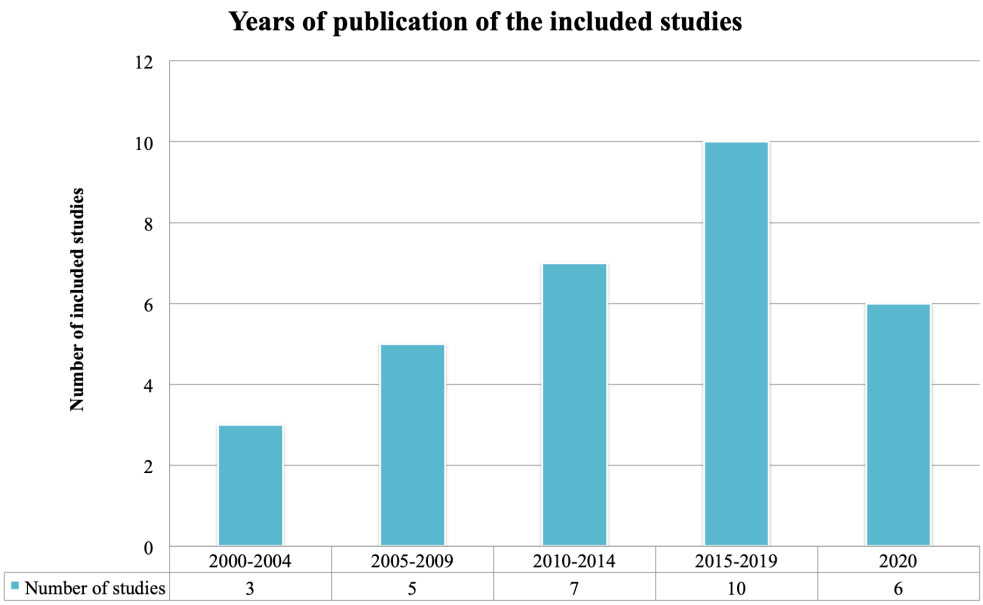


Figure 4.5 Periods of publication of included studies

4.6.2 Countries and regions

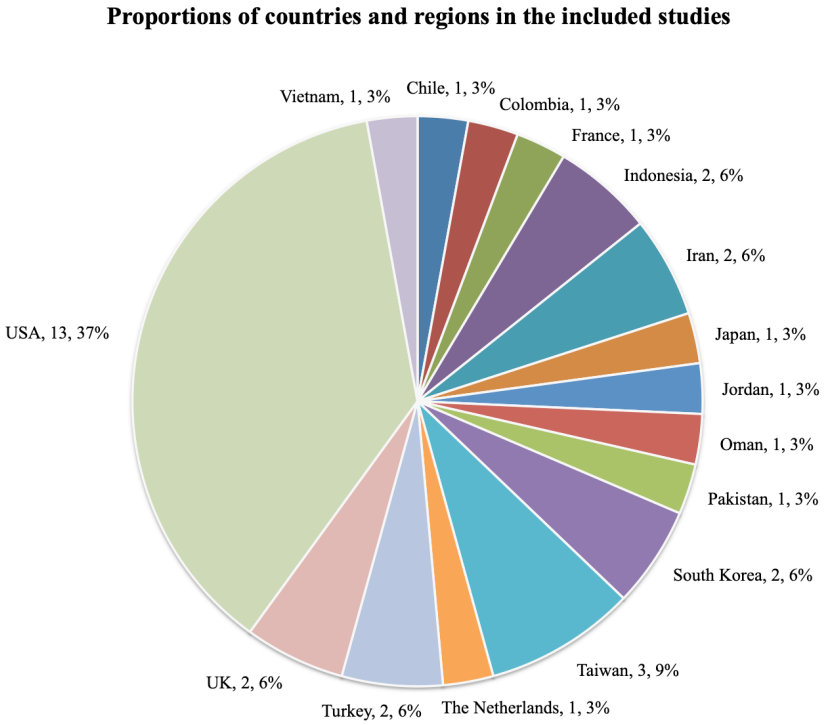


Figure 4.6 Proportions of countries and regions in the included studies

As shown in Figure 4.6 (refer to Appendix 14 for further details), the included studies were conducted in 16 countries and regions, spanning across Asia, Europe, the Middle East, North and South America, and thus embodied a fairly extensive representation of geographical locations. The most common country was the USA, where 37% of the included studies took place; the other countries and regions are highly diversified.

4.6.3 Settings

According to Figure 4.7 (refer to Appendix 15 for further details), the majority of the included studies were conducted in university settings.

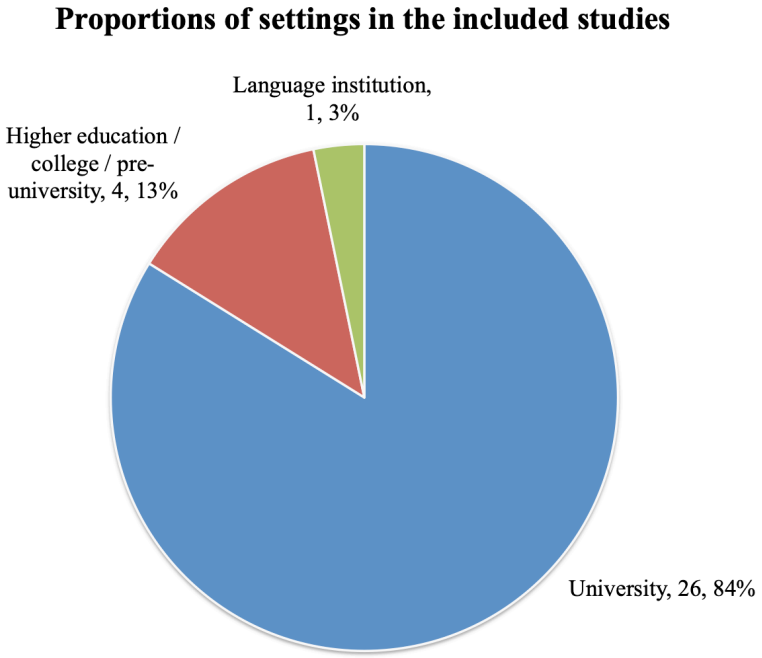


Figure 4.7 Proportions of settings in the included studies

4.6.4 Participants

Figure 4.8 (refer to Appendix 16 for further details) indicates that around three thirds of participants were university students, and a small proportion (13%) of participants with teaching backgrounds.

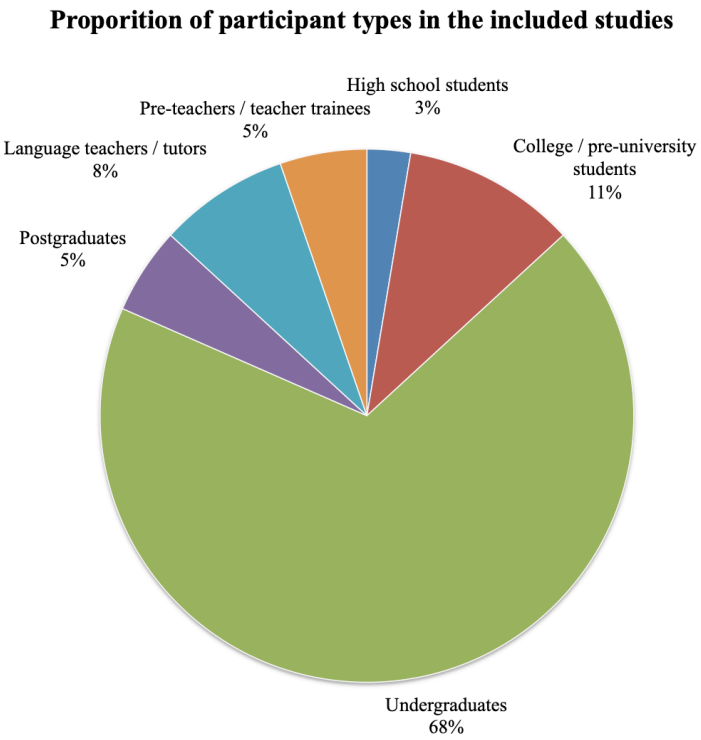


Figure 4.8 Proportions of participant types in the included studies

4.6.5 Sample sizes

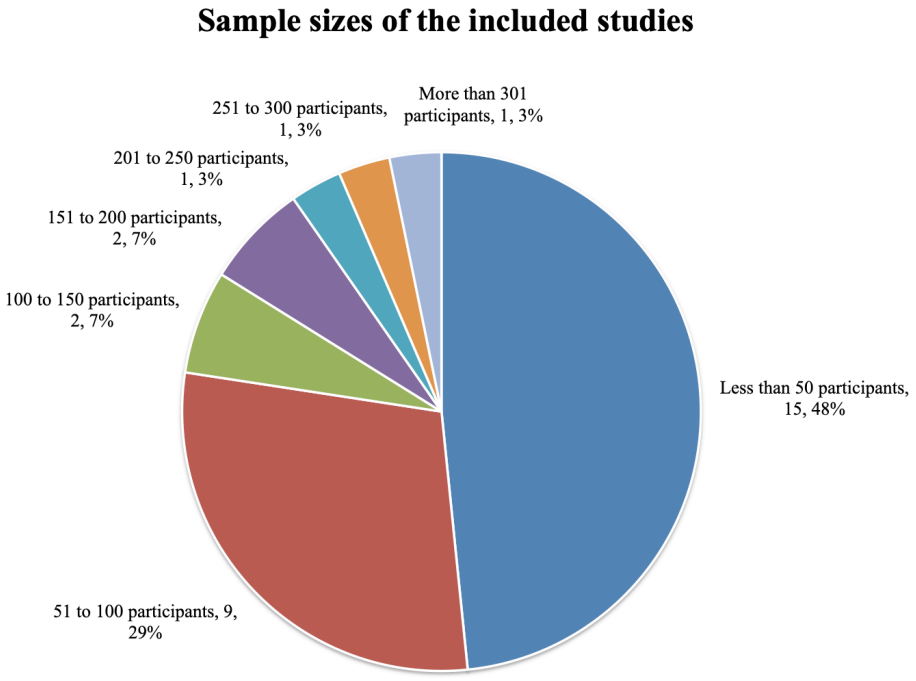


Figure 4.9 Sample sizes of the included studies

Figure 4.9 presents the distribution of sample sizes (refer to Appendix 17 for further details). The sample sizes ranged from 13 to 1,025 of participants, and around half of the included studies involved less than 50 participants.

4.6.6 Languages

The participants of the included studies represented 16 L1s, from which English (22%), Chinese (11%) and Korean (11%) were the three most common. Figure 4.10 presents the proportions of L1s in the included studies (refer to Appendix 18 for further details).

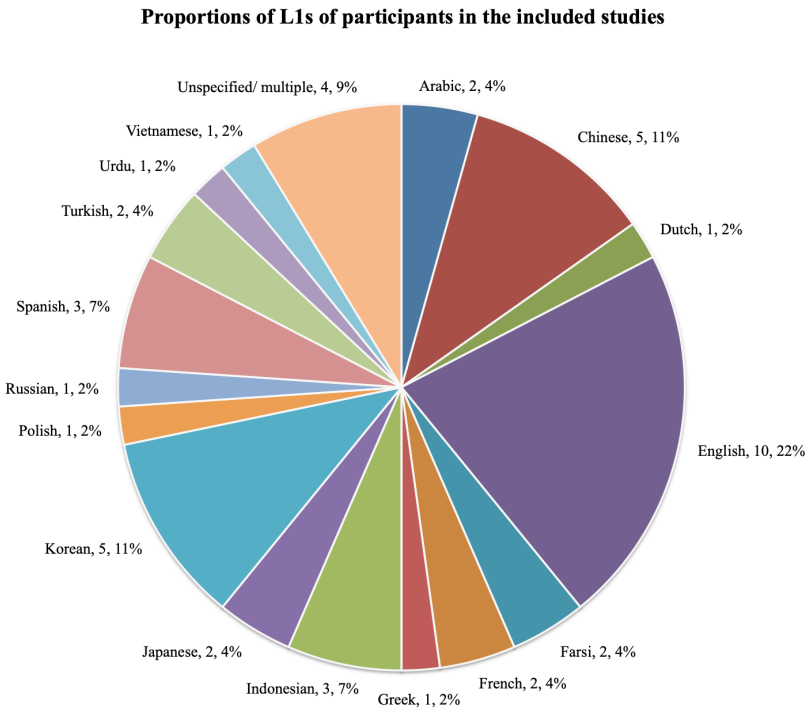


Figure 4.10 Proportions of L1s of participants

The number of L2s of participants included 6 types of languages, and English (55%) was the most common L2.

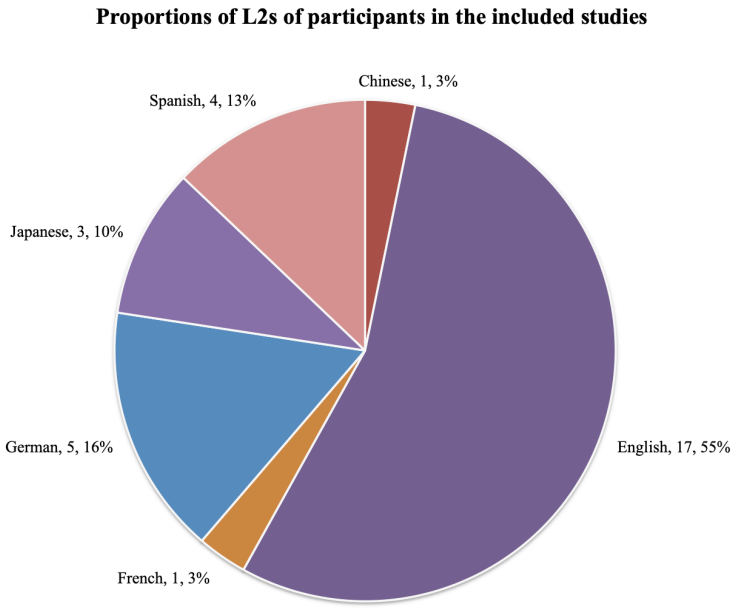


Figure 4.11 Proportions of L2s of participants

4.6.7 Skills and levels of L2 courses

As shown in Figure 4.12 (refer to Appendix 18 for further details), general language skills were most commonly taught in the L2 courses of the included studies, followed by productive skills of speaking and writing, and vocabulary. Receptive skills, namely reading and listening, were not taught independently in the L2 courses.

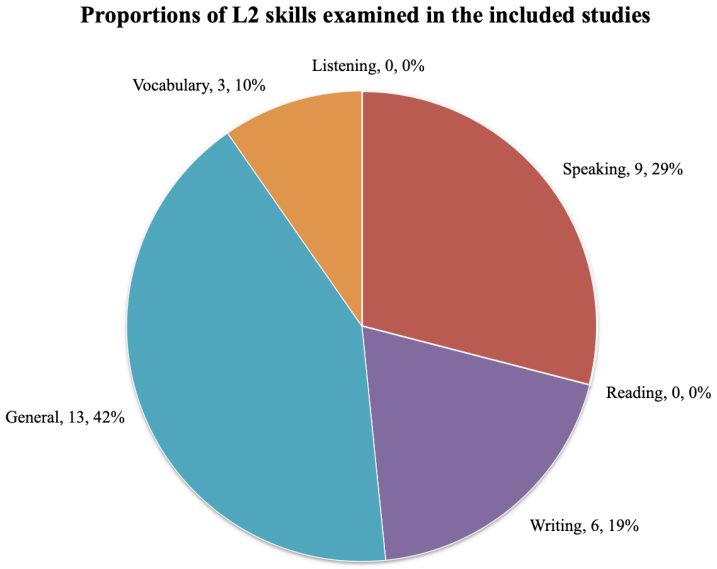


Figure 4.12 Proportions of L2 skills examined

The L2 courses covered all levels of proficiency, and most courses were at the intermediate level (29%). The details pertaining to the levels of L2 courses are summarised in Figure (also in Appendix).

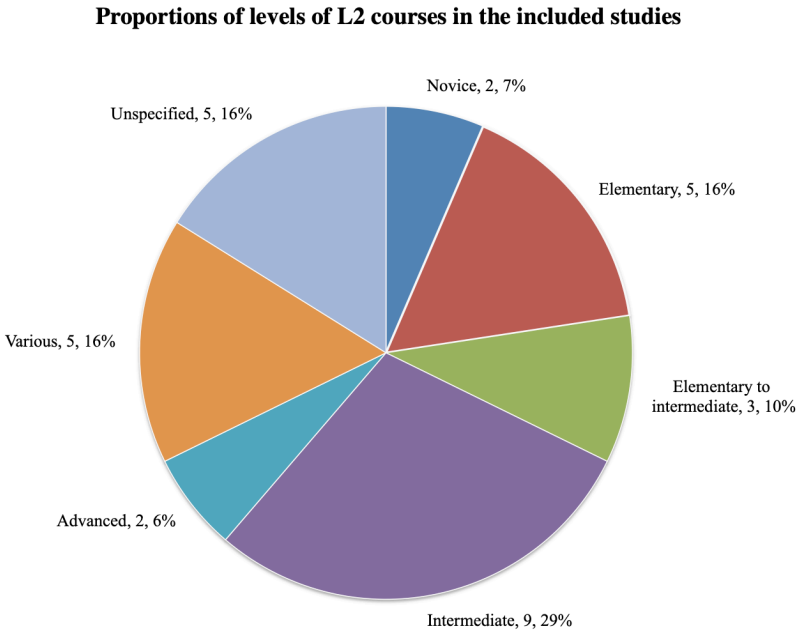


Figure 4.13 Proportions of levels of L2 courses

4.7 DE modes

4.7.1 L2 courses

In total, 50 L2 courses comprising of the three DE modes were examined in the included studies, as illustrated in Figure 4.14 below (refer to Appendix 21 for further details). The proportions of the DE modes were relatively even, thus providing a reasonably balanced comparison of the modes.

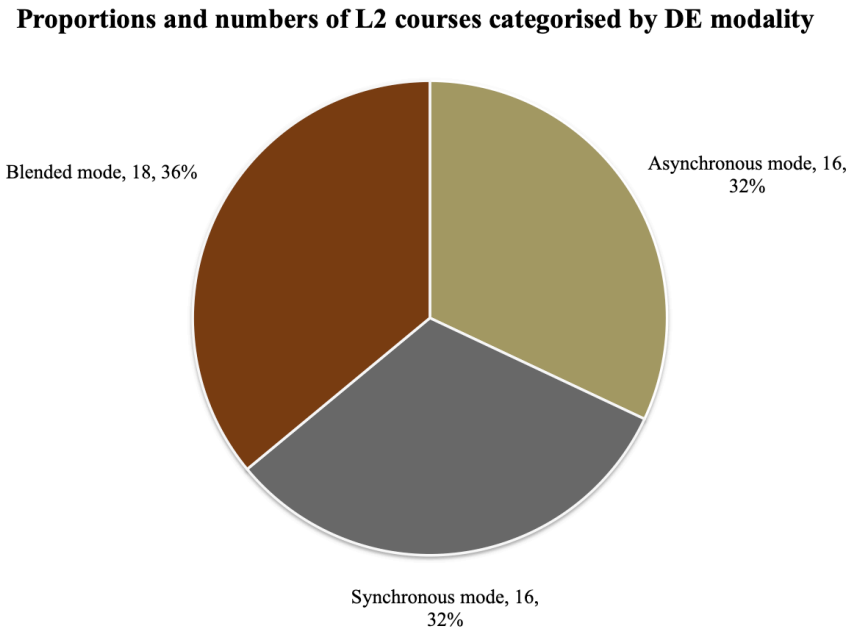


Figure 4.14 Proportions and numbers of L2 courses categorised by DE modality

4.7.2 Media and technology

The L2 courses of the three DE modes were delivered by applying a wide range of media and technology, which totalled 86 instances of applications. According to Figure 4.15 (Appendix 22), the frequencies of media and technology applied in asynchronous (30%) and synchronous modes (26%) were similar. Since the blended mode combined the

media and technology of both modes, the variety of applications that constituted the blended courses was consequently greater (44%).

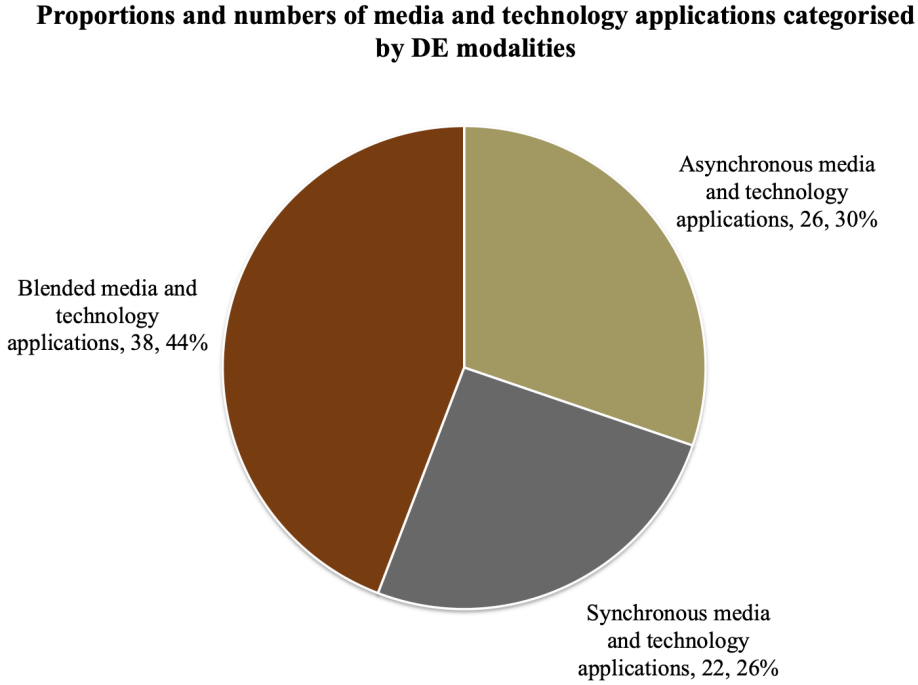


Figure 4.15 Proportions and numbers of media and technology applications categorised by DE modality

Overall, the included studies consisted of a comprehensive range of media and technology in the fourth and fifth generation of DE development, which is characterised by computer assisted language learning (CALL) and web-based interactions (discussed in Section 2.2.1 of literature review and in Appendix 4). Further details of each DE mode are presented in the ensuing sub-sections.

4.7.2.1 Asynchronous media and technology

As summarised in Figure 4.16 (refer to Appendix 23 for further details), 10 types of asynchronous media and technology were recorded in the included studies, with a total of 26 applications. The most common asynchronous media and technology was ‘bulletin

boards, fora and threaded discussion', which were grouped together as a single type of application due to their parallel features, and accounted for around a third of the asynchronous applications.

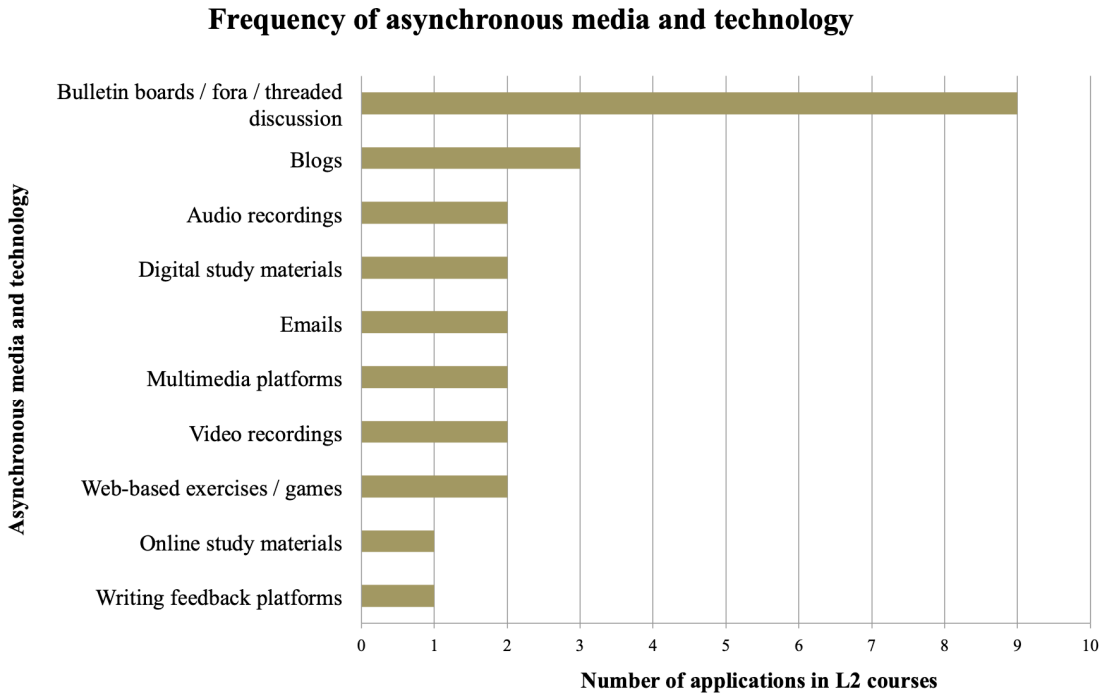


Figure 4.16 Number of applications of asynchronous media and technology

4.7.2.2 Synchronous media and technology

As summarised in Figure 17 (refer to Appendix 24 for further details), 11 types of synchronous media and technology and 22 applications were reported, of which video-conferencing and multimedia platforms were the two most frequently applied applications, each representing 18% of synchronous applications of media and technology.

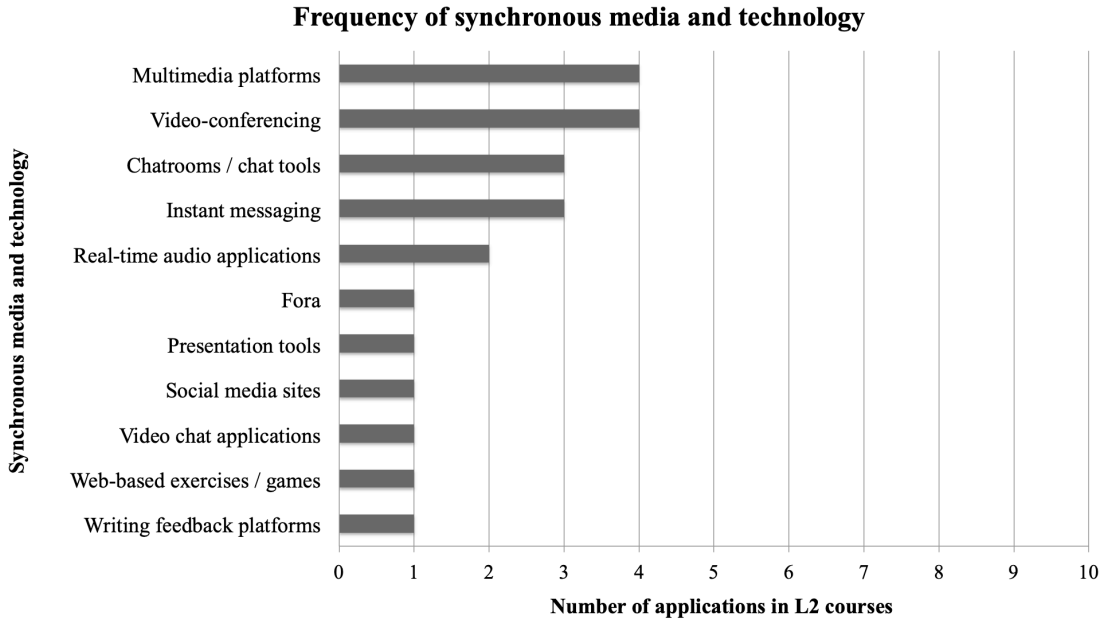


Figure 4.17 Number of applications of synchronous media and technology

4.7.2.3 Blended media and technology

The blended media and technology combined those of the asynchronous and synchronous modes, which together amounted to 16 types of media and technology and 44 applications, as summarised in Figure 4.18 (refer to Appendix 25 for further details). Video-conferencing was the most frequently applied synchronous media and technology (15%), followed by asynchronous web-based exercises and games (10%).

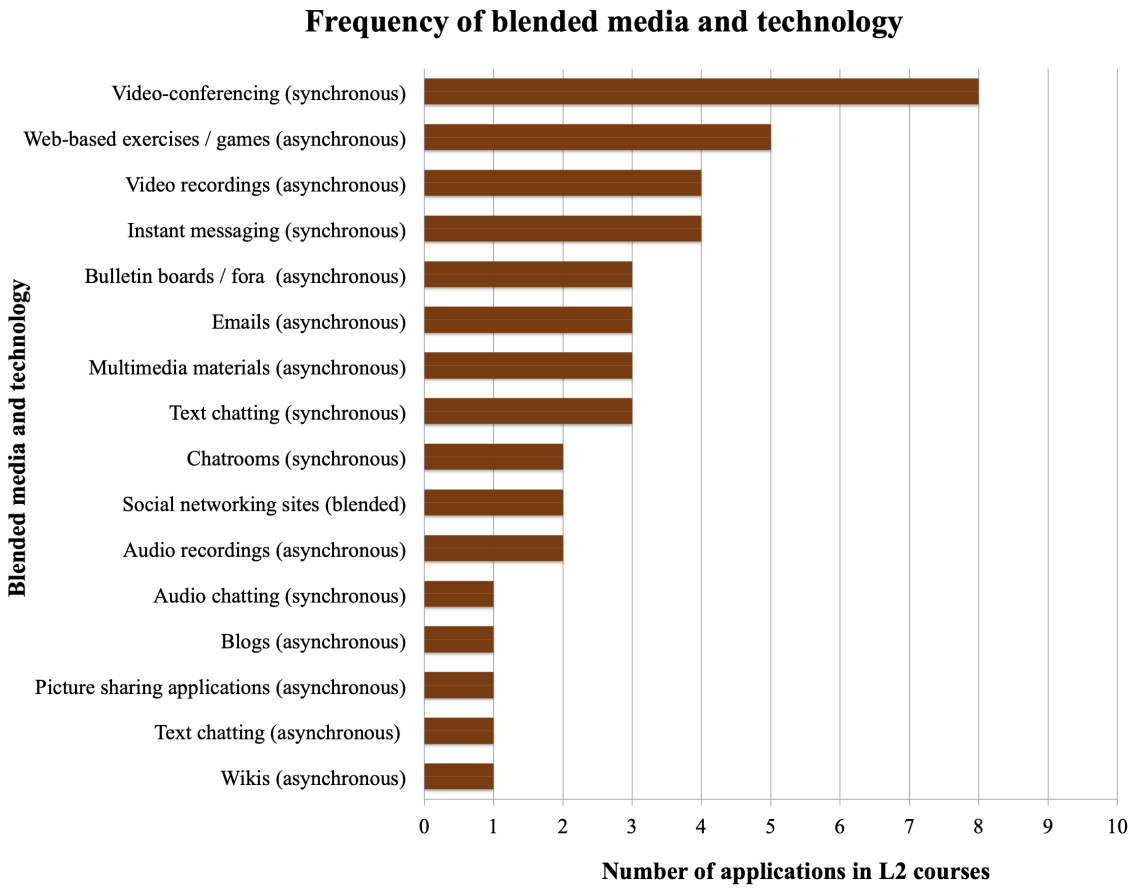
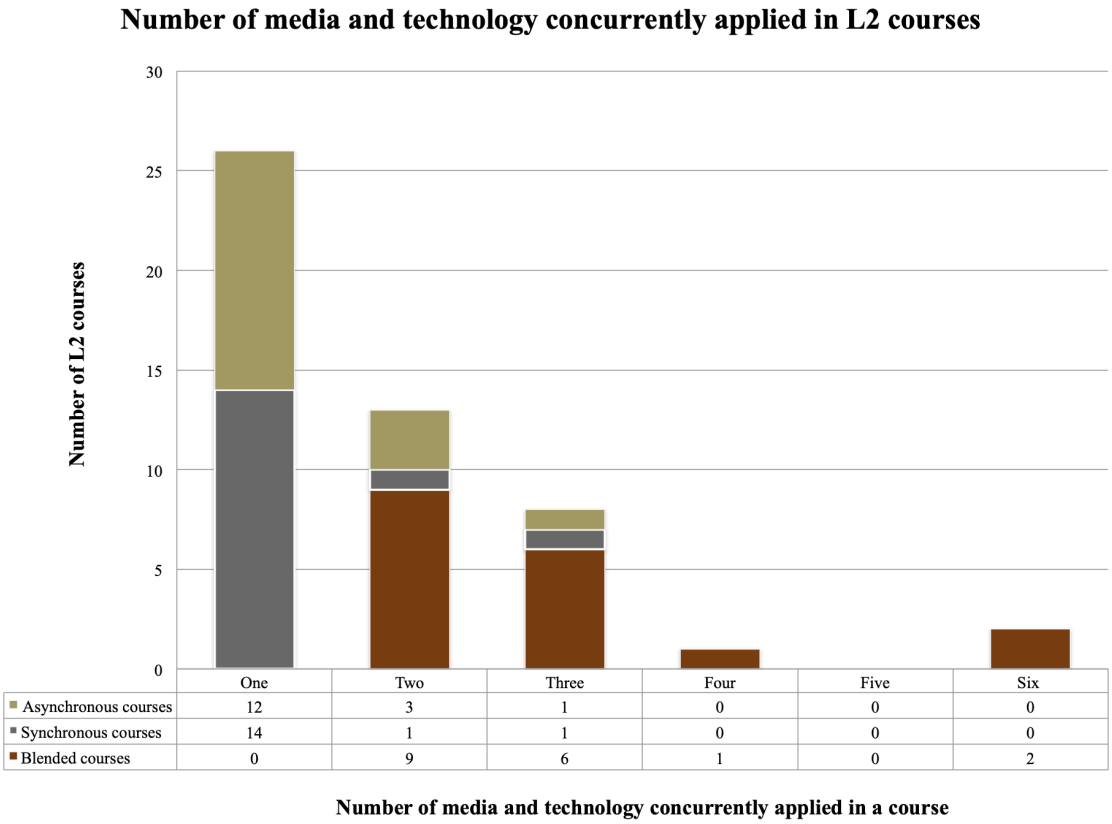


Figure 4.18 Number of applications of blended media and technology

4.7.3 Concurrent applications of media and technology

According to Figure 4.19 (refer to Appendix 26 for further details), 26 of the 50 L2 courses in the included studies were delivered using one type of media and technology, and the courses were conducted either in the asynchronous (24% of L2 courses) or the synchronous mode (28%). Among the 23 L2 courses conducted by multiple types of media and technology, 18 courses were in the blended mode and concurrently applied 2 to 6 types of media and technology. The average numbers of media and technology concurrently applied per course were 1.31, 1.18, and 2.89 in asynchronous, synchronous and blended courses respectively.



	One	Two	Three	Four	Five	Six
Asynchronous courses	12	3	1	0	0	0
Synchronous courses	14	1	1	0	0	0
Blended courses	0	9	6	1	0	2

Figure 4.19 Number of media and technology concurrently applied in L2 courses

4.8 Transactional distance (TD)

Figure 4.20 presents the TD levels of DE modes in the included studies individually, and the frequencies of the TD levels are tallied in Figure 4.21.

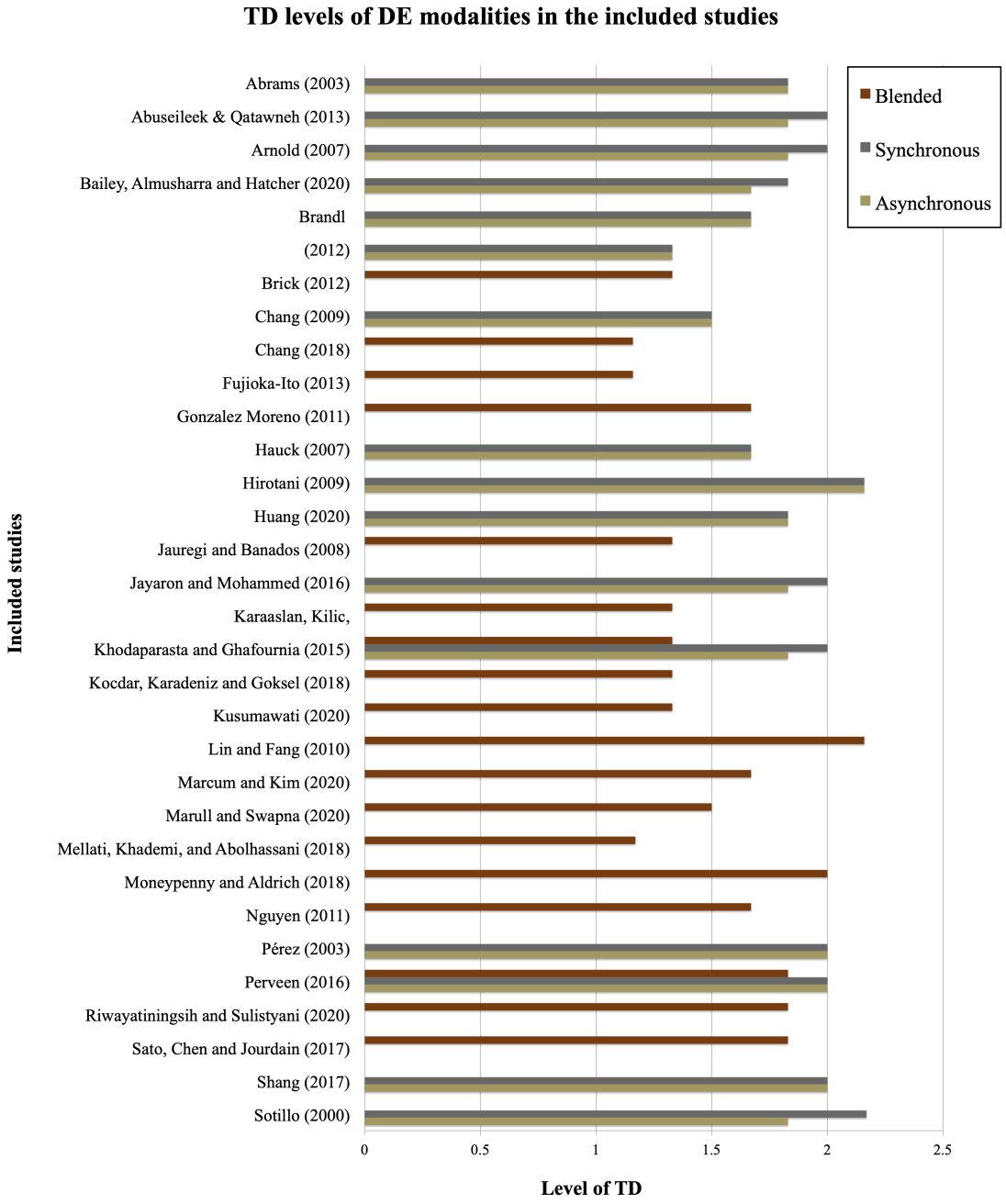
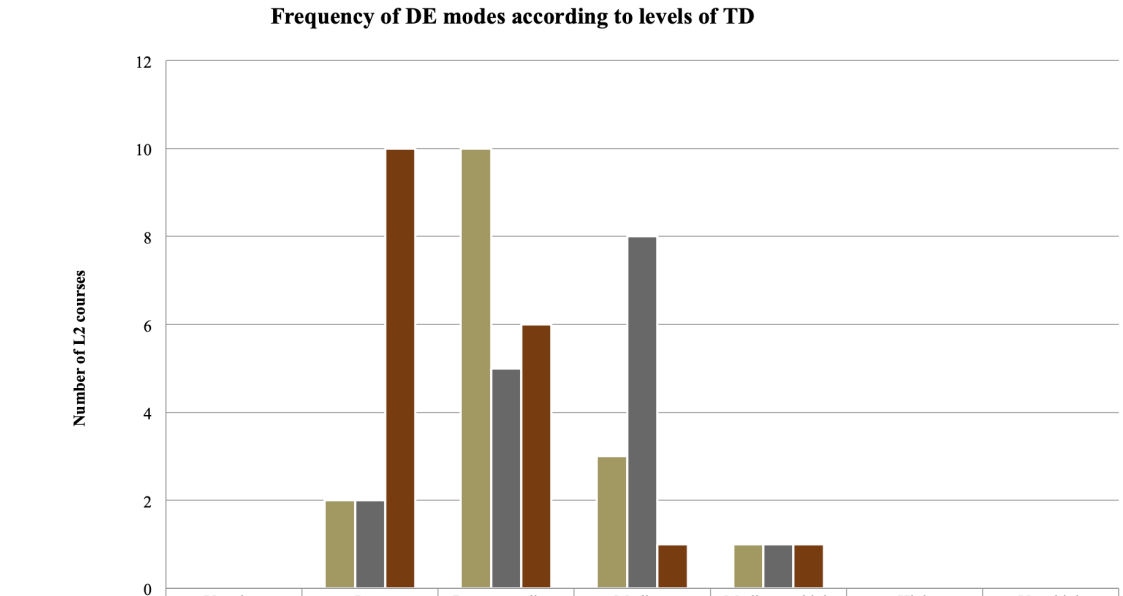


Figure 4.20 TD levels of DE modes in the included studies



	Very low	Low	Low to medium	Medium	Medium to high	High	Very high
Asynchronous mode	0	2	10	3	1	0	0
Synchronous mode	0	2	5	8	1	0	0
Blended mode	0	10	6	1	1	0	0

Figure 4.21 Frequency of TD levels according to DE modality

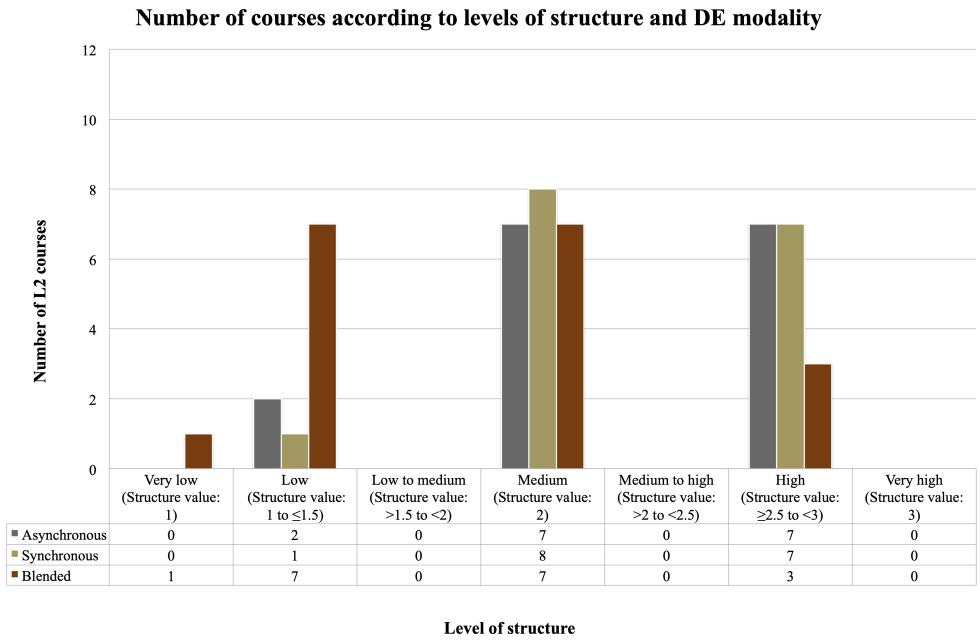
The SLL/FLL courses of the included studies were categorised into four classes of TD levels, including 'low' (28%), 'low to medium' (42%), 'medium' (24%) and 'medium to high' (6%). In an ascending order of TD levels, 32% of blended courses were below the 'medium' classification of TD levels, followed by 24% for asynchronous courses, and 14% of synchronous courses. In the category of 'medium' or above, 60% of the courses were conducted using the synchronous mode, which was substantially higher than 8% and 4% of courses based on asynchronous and blended modes respectively.

The levels of TD were denoted based on the pre-determined ranges of numeric scores (refer to Table 3.2 and Appendix 31 for details) computed by averaging the scores of three constituent variables: structure, dialogue and autonomy. In every course reported by the included studies, a score between 1 and 3 was assigned to each variable. Based on the TD theory and hypothesis, the score of structure is proportional to the level of TD, and inversely related to the scores of dialogue and autonomy. The following sub-sections report the results of the TD variables.

4.8.1 Variables

By analysing the distribution of scores in each TD variable (Figures 4.22-4.24 and Appendices 27-29), a similar pattern is also detectable; TD scores are lowest in the blended mode, followed by the asynchronous mode, and highest in the synchronous mode.

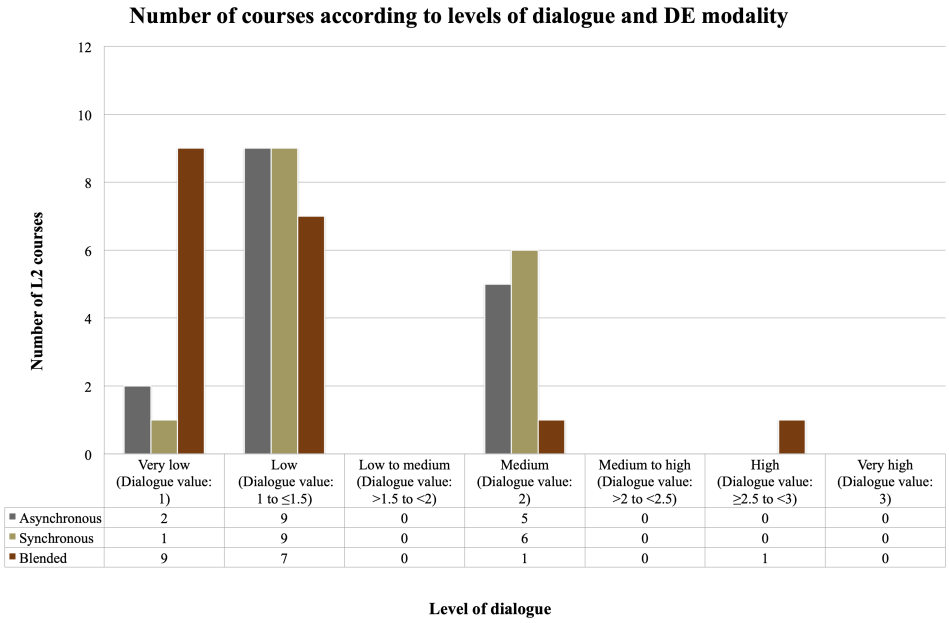
4.8.1.1 Structure



	Very low (Structure value: 1)	Low (Structure value: 1 to ≤1.5)	Low to medium (Structure value: >1.5 to <2)	Medium (Structure value: 2)	Medium to high (Structure value: >2 to <2.5)	High (Structure value: ≥2.5 to <3)	Very high (Structure value: 3)
Asynchronous	0	2	0	7	0	7	0
Synchronous	0	1	0	8	0	7	0
Blended	1	7	0	7	0	3	0

Figure 4.22 Number of courses according to levels of structure and DE modality

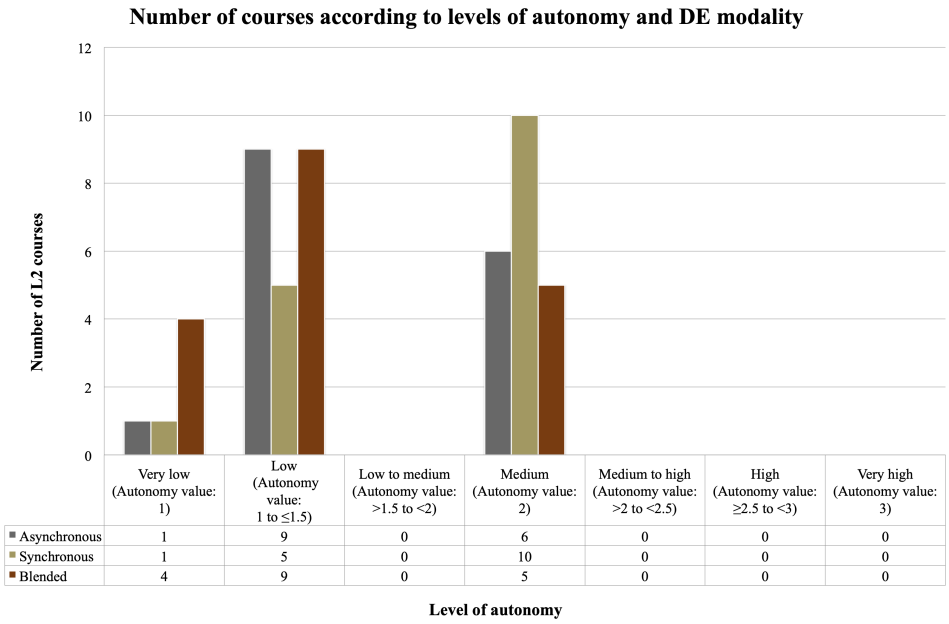
4.8.1.2 Dialogue



	Very low (Dialogue value: 1)	Low (Dialogue value: 1 to ≤1.5)	Low to medium (Dialogue value: >1.5 to <2)	Medium (Dialogue value: 2)	Medium to high (Dialogue value: >2 to <2.5)	High (Dialogue value: ≥2.5 to <3)	Very high (Dialogue value: 3)
Asynchronous	2	9	0	5	0	0	0
Synchronous	1	9	0	6	0	0	0
Blended	9	7	0	1	0	1	0

Figure 4.23 Number of courses according to levels of dialogue and DE modality

4.8.1.3 Autonomy

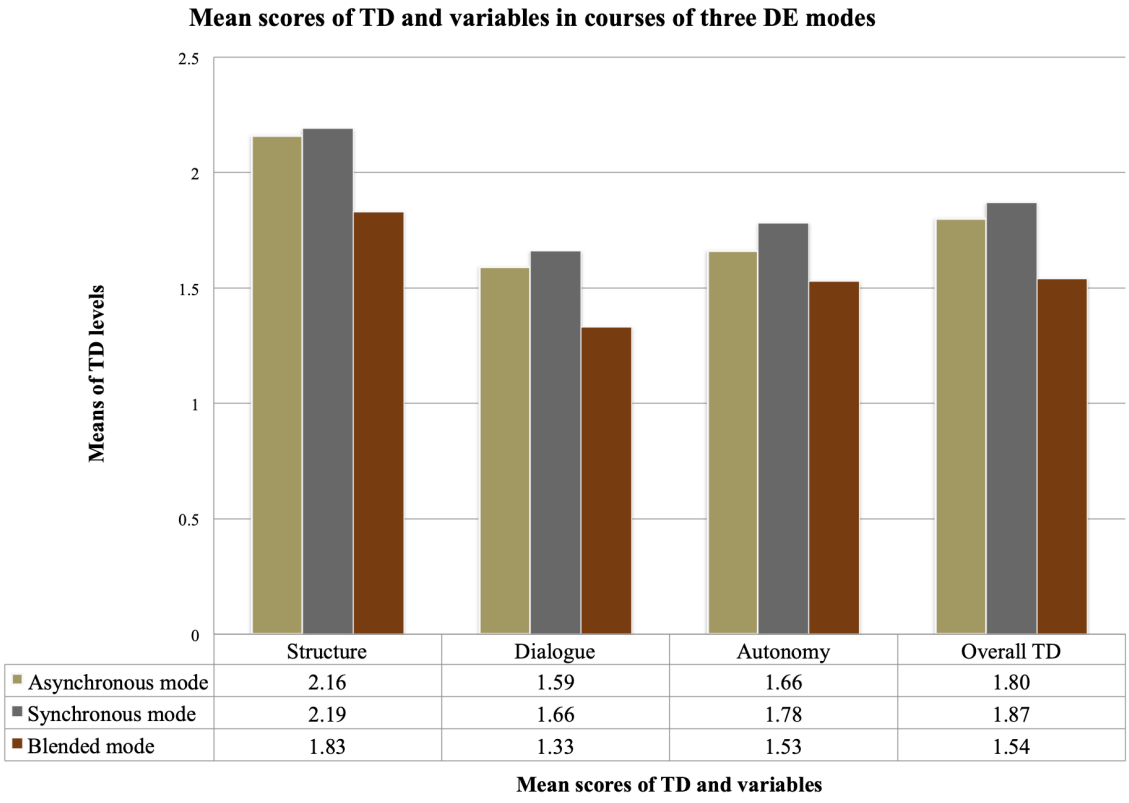


	Very low (Autonomy value: 1)	Low (Autonomy value: 1 to ≤1.5)	Low to medium (Autonomy value: >1.5 to <2)	Medium (Autonomy value: 2)	Medium to high (Autonomy value: >2 to <2.5)	High (Autonomy value: ≥2.5 to <3)	Very high (Autonomy value: 3)
Asynchronous	1	9	0	6	0	0	0
Synchronous	1	5	0	10	0	0	0
Blended	4	9	0	5	0	0	0

Figure 4.24 Number of courses according to levels of autonomy and DE modality

4.8.2 Comparison of TD levels and variables across DE modes

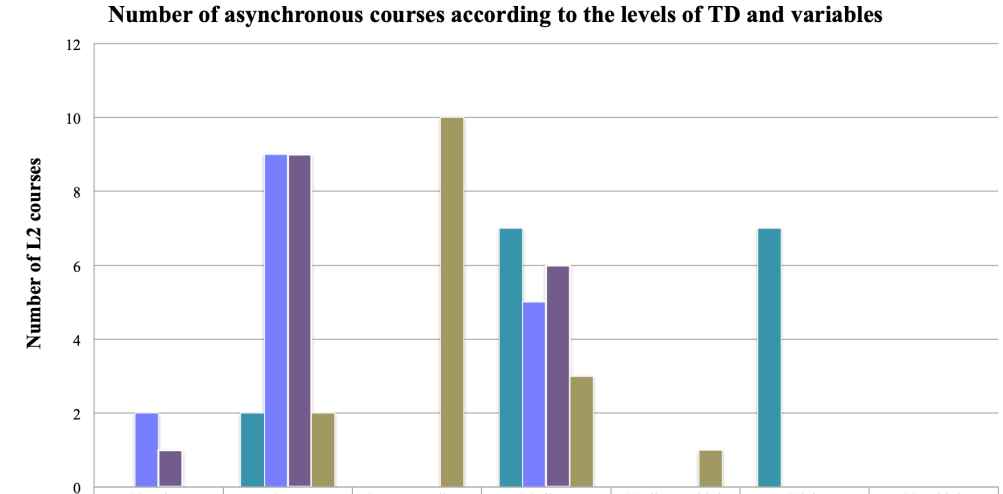
By and large, the levels of TD of all DE modes are in the 'low to medium' category. The comparisons of mean scores of TD and variables in Figure 4.25, in conjunction with TD levels of each DE mode in Figures 4.26 to 4.28 (refer to Appendices 32-37 for further details), differentiate the DE modality by indicating the lowest TD levels in courses conducted in the blended mode, a relatively larger TD in the asynchronous mode, and the highest TD levels in the synchronous mode.



	Structure	Dialogue	Autonomy	Overall TD
Asynchronous mode	2.16	1.59	1.66	1.80
Synchronous mode	2.19	1.66	1.78	1.87
Blended mode	1.83	1.33	1.53	1.54

Figure 4.25 Mean scores of TD and variables of three DE modes

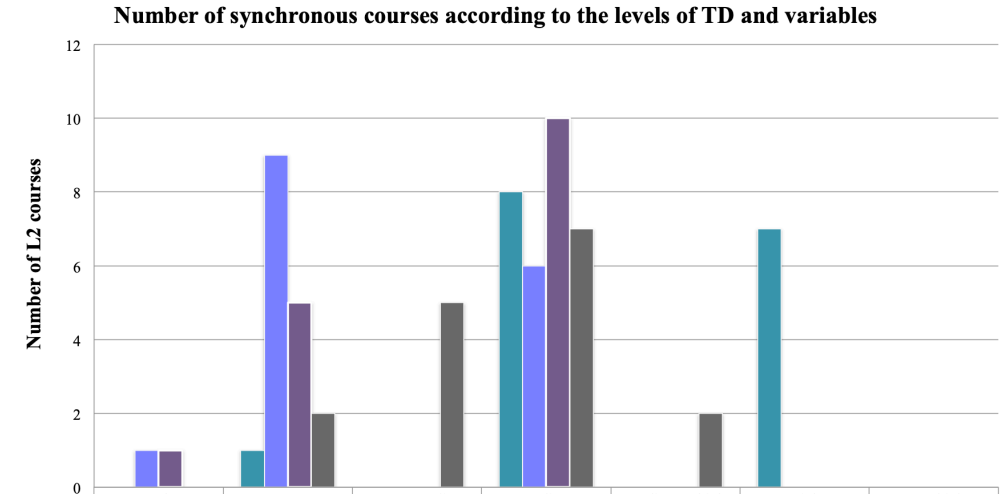
4.8.2.1 Asynchronous mode



	Very low (Score: 1)	Low (Score: 1 to ≤1.5)	Low to medium (Score: >1.5 to <2)	Medium (Score: 2)	Medium to high (Score: >2 to <2.5)	High (Score: ≥2.5 to <3)	Very high (Score: 3)
Structure	0	2	0	7	0	7	0
Dialogue	2	9	0	5	0	0	0
Autonomy	1	9	0	6	0	0	0
Overall TD	0	2	10	3	1	0	0

Figure 4.26 Number of asynchronous courses according to TD levels and variables

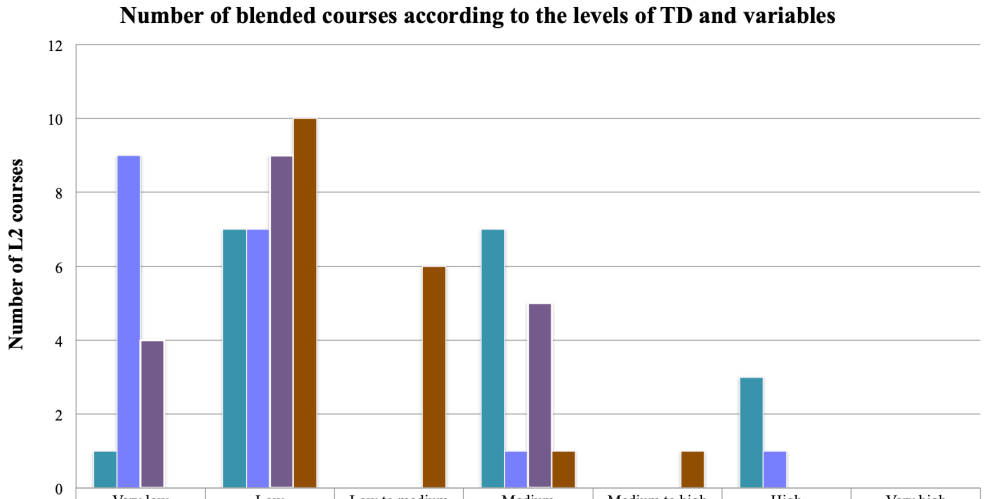
4.8.2.2 Synchronous mode



	Very low (Score: 1)	Low (Score: 1 to ≤1.5)	Low to medium (Score: >1.5 to <2)	Medium (Score: 2)	Medium to high (Score: >2 to <2.5)	High (Score: ≥2.5 to <3)	Very high (Score: 3)
Structure	0	1	0	8	0	7	0
Dialogue	1	9	0	6	0	0	0
Autonomy	1	5	0	10	0	0	0
Overall TD	0	2	5	7	2	0	0

Figure 4.27 Number of synchronous courses according to TD levels and variables

4.8.2.3 Blended mode



	Very low (Score: 1)	Low (Score: 1 to ≤1.5)	Low to medium (Score: >1.5 to <2)	Medium (Score: 2)	Medium to high (Score: >2 to <2.5)	High (Score: ≥2.5 to <3)	Very high (Score: 3)
Structure	1	7	0	7	0	3	0
Dialogue	9	7	0	1	0	1	0
Autonomy	4	9	0	5	0	0	0
Overall TD	0	10	6	1	1	0	0

Figure 4.28 Number of blended courses according to TD levels and variables

4.9 Measurements and results

The outcome of L2 courses of the three DE modes were reported by 67 records of measurement in the four broad categories of L2 learning, perception and attitude, emotion, and motivation. In aggregate, the results of DE courses have provided supportive evidence of DE effectiveness; 64% of the findings were positive (i.e. statistically significant or exhibited compellingly affirmative results), and only one record (1.4%) of negative result. As presented in Table 4.4 and Figure 4.29 (refer to Appendices 38-40 for complete details), the majority of measurements included perception and attitude of participants (52%) and the outcome of L2 learning (42%).

Table 4.3 Number of results in included studies according to types of measures

Types of measurements	Number of results							
	Positive		Mixed		Negative		Sub-totals	
	n	%	n	%	n	%	n	%
L2 learning	20	47%	8	35%	0	0%	28	42%
Emotion	0	0%	2	9%	0	0%	2	3%
Motivation	1	2%	1	4%	0	0%	2	3%
Perception and attitude	22	51%	12	52%	1	100%	35	52%
Total	43		23		1		67	

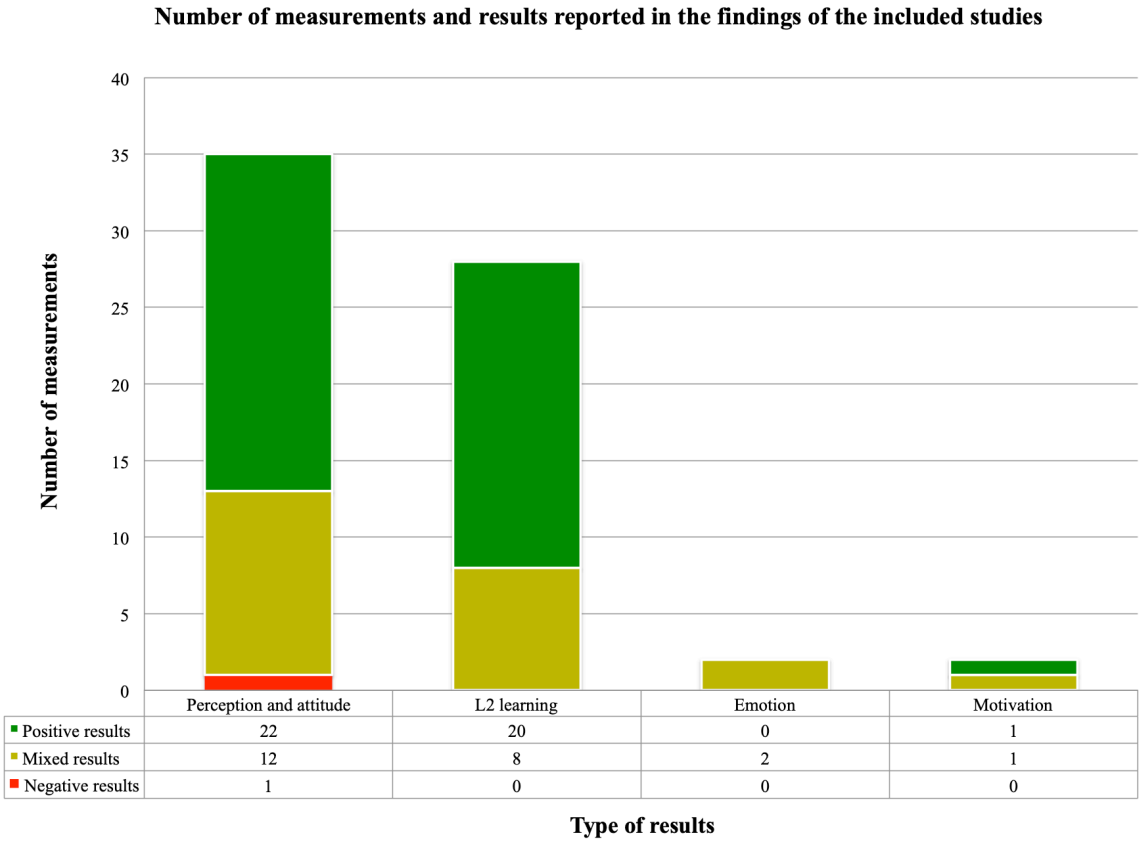
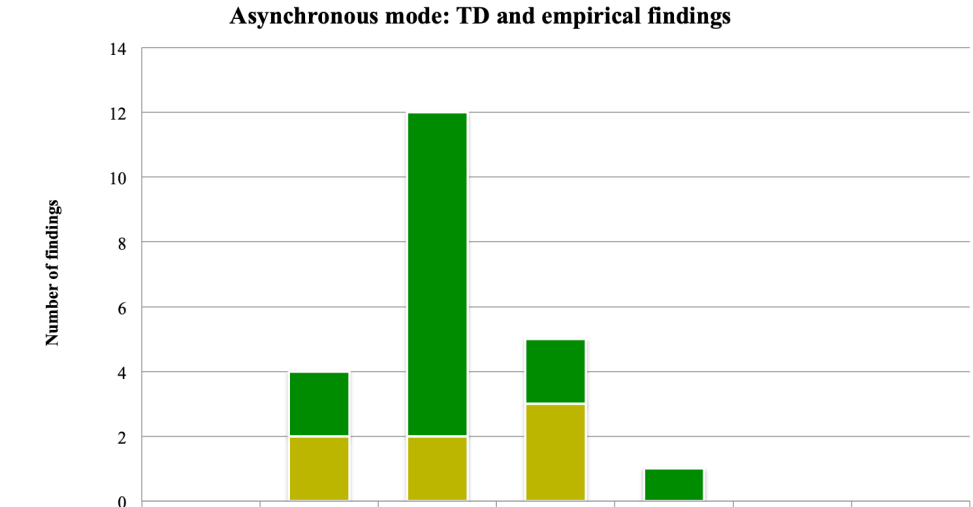


Figure 4.29 Number of measurements and results reported by the included studies

As shown in Figures 4.29 to 4.31, the numbers of positive results were concentrated in courses with TD levels that are 'low' and 'low to medium', regardless of DE modality.

This is particularly evident in the blended mode, of which all the positive results were exclusively reported in courses with TD levels at the 'low' and 'low to medium' levels. Moreover, the number of positive results was highest in the blended mode (79% of all measurements), compared with 68% and 50% of the measurements in the asynchronous and synchronous mode respectively. Furthermore, it is worth noting that the proportion of measurements in the 'low' and 'low to medium' TD levels was highest in courses conducted in the blended mode (91.6%), followed by that of the asynchronous (72.7%) and synchronous mode (45.4%).

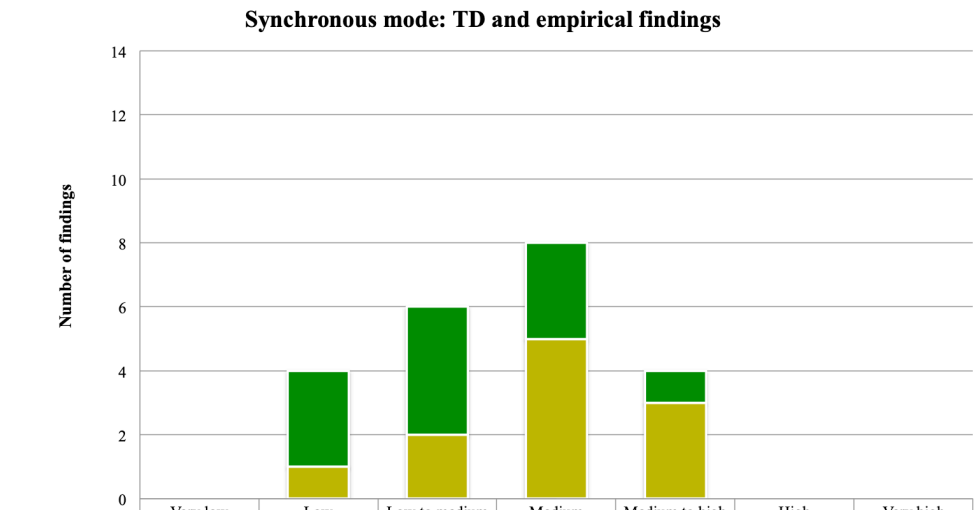
4.9.1 Asynchronous mode



	Very low	Low	Low to medium	Medium	Medium to high	High	Very high
Positive findings	0	2	10	2	1	0	0
Mixed findings	0	2	2	3	0	0	0
Negative findings	0	0	0	0	0	0	0

Figure 4.30 TD levels and empirical findings of courses conducted in asynchronous mode

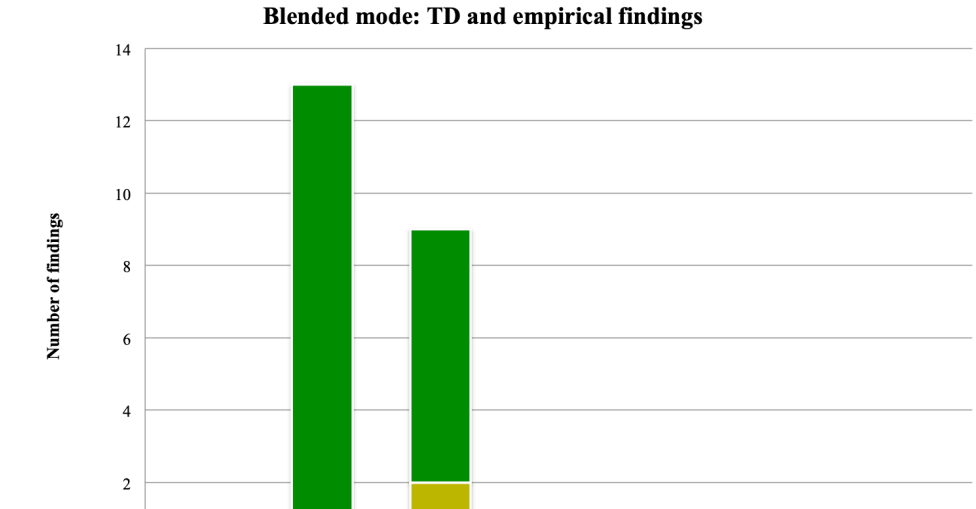
4.9.2 Synchronous mode



	Very low	Low	Low to medium	Medium	Medium to high	High	Very high
Positive findings	0	3	4	3	1	0	0
Mixed findings	0	1	2	5	3	0	0
Negative findings	0	0	0	0	0	0	0

Figure 4.31 TD levels and empirical findings of courses conducted in synchronous mode

4.9.3 Blended mode



	Very low	Low	Low to medium	Medium	Medium to high	High	Very high
Positive findings	0	12	7	0	0	0	0
Mixed findings	0	1	2	1	0	0	0
Negative findings	0	0	0	0	1	0	0

Figure 4.32 TD levels and empirical findings of courses conducted in blended mode

4.10 Summary of findings

Following the procedures set out in the methodology, 31 articles were winnowed from the original sample of 308 articles on the basis of relevance to the current study, adequacy of details and clarity, validity and quality of findings (WOE), and inter-rater and intra-rater reliability. Published in the span of two decades, the body of research exhibits a representative sample of empirical investigations, embodying a diverse variety of characteristics, backgrounds and contexts, countries and regions, educational settings, L1s and L2s, L2 skills and proficiency levels, research design, data collection, lengths of investigation, participant types, sample sizes, types and concurrent applications of media and technology, and measurements in the categories of L2 learning, perception and attitudes, emotion and motivation.

By comparing the TD levels, scores of TD variables, measurements and results of L2 courses conducted in three DE modes, a number of distinct findings were observed. The blended mode was associated with a lower level of TD and a higher proportion of positive results, whereas the asynchronous mode exhibited a higher level of TD but a smaller proportion of positive results. In contrast, the synchronous mode was the DE mode associated with the highest levels of TD and the lowest proportion of positive results. Last but not least, the number of media and technology concurrently applied was greatest in courses conducted in the blended mode, followed by the asynchronous mode, and the least in the synchronous mode.

5. Discussion

To examine the effectiveness of DE in SLL/FLL courses in the framework of TDT, the findings of this systematic review are drawn on to address the three research questions by discussing the relationships among the TD levels, DE modality and outcomes reported in the included studies.

5.1 Research Question 1: Effectiveness of DE modes

With regard to Research Question 1, *'To what extent are different DE modes (i.e. asynchronous, synchronous and blended) effective in SLL/FLL?'*, the included studies had reported positive results in all DE modes, suggesting general effectiveness of DE in SLL/FLL.

The degree of effectiveness, as indicated by the proportion of positive results, varied according to DE modality. As summarised in the previous chapter, the asynchronous mode was apparently more potent than the synchronous mode, and their combination in the blended mode, was associated with the greatest number of positive results. These findings highlight three key issues that warrant further discussion.

The first issue concerns the divergence of perspectives of DE, as expounded in the literature review. From the more traditional perspective, DE is conceived as an approximation of CI, which could be optimally replicated by the real-time delivery of DE courses conducted in the synchronous mode. This perspective is based on the assumption that CI is the paragon of education. In contrast, the diametrical perspective conceptualises DE as an inherently distinct form of education in its own right, and embraces a broader array of approaches of limited synchronicity; this is epitomised by the asynchronous mode, which is not designed based on the principle of replicating the synchronicity of CI. Based on the assumption of the former perspective, the synchronous mode should be more effective because of their similarity with CI. However, the findings of this study are largely incongruent with the CI-oriented argument of DE. In fact, the preponderance of

the asynchronous mode is more aligned with the latter perspective that considers DE as distinct from, rather than an epitome of CI.

The second issue pertains to the sources of discrepancy between the asynchronous and synchronous mode. In the included studies, the synchronous mode was predominantly delivered using video-conferencing and instant messaging, enabling instantaneous exchange of video, textual and audio input between the teachers and learners and among the peers. The benefit of immediacy could have facilitated interaction in the learning process, as reported in the included studies (Huang, 2020; Perveen, 2016; Pérez, 2003). Results of the included studies also indicated that the sense of proximity in synchronous interaction could be a motivating factor for learners and also contributed to L2 learning, such as the improvement in syntactic complexity and acquisition of language units (Hirotani, 2009; Jayaron & Mohammed, 2016).

Despite the possible benefits, the synchronous mode was found to be deficient in several aspects. Akin to the limitations of CI, the scheduling of synchronous interaction was often found to be inconvenient or unfeasible in some included studies (Chang, 2009; Hauck, 2007). Moreover, some learners experienced greater anxiety (Hauck, 2007) and cognitive load (Bailey et al., 2020) in synchronous interaction. Such limitations were not found in courses conducted asynchronously, as learners were given more time to reflect and prepare their participation (Abuseileek & Qatawneh, 2013) and received more personalised feedback from teachers (Pérez, 2003; Perveen, 2016), and as a result, stronger findings of L2 learning were found in some studies (Shang, 2017; Sotillo, 2000). On balance, the effectiveness of the asynchronous mode was moderately higher than that of the synchronous mode, but the extent of advantage remains equivocal as mixed results were reported in the included studies (Abrams, 2003; Arnold, 2007; Brandl, 2012; Chang, 2009; Hauck, 2007; Hirotani, 2009; Huang, 2020; Pérez, 2003; Perveen, 2016).

The third issue relates to the overall effectiveness of the blended mode (Brick, 2012; Chang, 2018; Fujioka-Ito, 2013; Jauregi & Banados, 2008; Karaaslan et al., 2018; Kocdar et al., 2018; Kusumawati, 2020; Marcum & Kim, 2020; Marull & Swapna, 2020; Mellati

et al., 2018; Nguyen, 2011), and more positive results were reported vis-à-vis the synchronous and asynchronous modes in most of the included studies (Khodaparasta & Ghafournia, 2015; Perveen, 2016; Riwayatiningsih & Sulistyani, 2020). It could be postulated that the effectiveness of the blended mode was attributable to the complementary effects of the respective characteristics of the asynchronous and synchronous modes. In other words, the shortcomings of the two modes could presumably be compensated by the constructive characteristics of one another. For instance, for learners who are prone to anxiety or cognitively overburdened in synchronous interactions, the asynchronous mode could provide them with the opportunity to refine their input and interact more productively at their own pace, thereby overcoming psychological or cognitive obstacles that could encumber learning. In addition, as reported in the study of Chang (2009), some learners with lower L2 proficiency were unable to catch up with the content in synchronous courses, thereupon underscoring the importance of asynchronous learning as the source of additional exposure to the target language. The study of Shang (2017) is a case in point, where weaker learners lacking the confidence to participate synchronously benefitted from learning the peer responses in asynchronous interaction. Nonetheless, some learners might not be accustomed to delayed responses and thus remained inactive without the real-time engagement of the teacher and peers (Perveen, 2016), and the inclusion of synchronous meetings might befittingly satisfy their propensity for the immediacy of interaction, a greater sense of community, and more negotiation of meaning about the learning content instantaneously (Chang, 2009; Pérez, 2003).

Another factor that might account for the superiority of the blended mode concerned the concurrent applications of media and technology. By combining asynchronous and synchronous modes, the average number of media and technology concurrently applied in a blended course is substantially higher. On average, 2.89 types of media and technology were deployed per course in the blended mode, compared with 1.31 and 1.18 types in asynchronous and synchronous courses respectively. Therefore, it could also be inferred that the effectiveness of DE is positively correlated with the number of media and technology applied on a SLL/FLL course.

5.2 Research Question 2: TD levels and DE modes

With regard to the second research question, *'To what extent are TD levels different across the DE modes?'*, the findings revealed marked differences among the asynchronous, synchronous and blended modes. The construct of TD, as defined in the literature review (Moore, 1972, 1973, 1989, 1990a, 1990b, 1993, 1994a, 1994b, 2007) and operationalised by Zhang (2003), represents the impediment to learners' engagement in DE, which may arise from cognitive, psychological, social, cultural and physical separations between the learner and the learning environment. Contrary to the common perception that synchronous interaction would lead to smaller obstacles between the teachers and learners (i.e. a lower TD), the results of the included studies indicated otherwise. Overall, the asynchronous mode manifested lower TD levels, which could be explicated by three possible reasons.

Firstly, owing to the aforesaid limitations of the synchronous mode, such courses were time bound and thus restricted the amount of language exposure and interaction between the participants, and therefore imposing potential barriers to dialogue. In contrast, learners of asynchronous courses had access to video recordings, web-based exercises, and various learning resources that were virtually unbounded by scheduling or content availability, thereby providing learners with ample opportunities of repeated exposures and self-managed interactions.

Secondly, asynchronous courses generally applied multiple media and technology per course, creating more opportunities for interaction, increased variety of learning methods, and greater exposure to the target language. The flexibility of combining multiple types of media and technology correspondently resulted in a lower rigidity of the course structure, while providing learners with ample resources to learn autonomously. The dual results of lower structure and higher autonomy also led to lower TD levels. Contrariwise, synchronous courses were mainly conducted with a single medium or technology, which were predominantly via video-conferencing. Without the supplement of out-of-class

learning or interactions, autonomy of learners could be limited, and teachers would be more likely to plan specific content according to the length of synchronous meetings, which could rigidify the course structure. Furthermore, in synchronous classes where the teacher-to-student ratio is high in a large learner community (Rice, 1994), the possibility of dialogue could become scarce. For productive peer-to-peer dialogue to take place, clear instructions and facilitation of teachers are necessitated, but the potential problem of uneven participation may occur when some learners are more proactive and proficient than the others (Perveen, 2016), and such variability of learning styles could diminish dialogue.

Thirdly, in spite of an absence of synchronicity, the asynchronous mode was not found to be prohibitive to learners' involvement in the learning process. Findings from the included studies (Chang, 2009; Hauck, 2007; Jayaron & Mohammed, 2016) generally concur with previous literature's notion of social presence (Rovai, 2000, 2002), namely the experience of psychological and physical presence of the teachers and peers (Short et al., 1976), and a sense of community and increased dialogue could emanate from the asynchronous mode (Borup et al., 2011; Rourke et al., 2001; Swan & Shih, 2005). These characteristics of asynchronous courses provide a reasonable explanation of a lower level of TD.

For the same reasons discussed in the first research question, the combination of asynchronous and synchronous modes could have contributed to the lowest TD in the blended mode. It is worth noting that collaborative learning, a factor connected to DE effectiveness (Grooms, 2003; Hiltz et al., 2000), was evidently found in a number of blended courses (Fujioka-Ito, 2013; Gonzalez Moreno, 2011; Marull & Swapna, 2020; Nguyen, 2011). On a standalone basis, the asynchronous or synchronous mode could be limited by either an absence of instantaneous exchange or time and scheduling restrictions, and might fail to cater for the individual differences of learners. For instance, some learners preferred reflecting on the content in several included studies (Abuseileek & Qatawneh, 2013; Perveen, 2016), a learning activity that could be classified as intrapersonal dialogue, which could be bolstered by self-paced learning such as solving

learning problems and watching video recordings (Gorsky & Caspi, 2005). In other words, learners with a higher level of autonomy could benefit from courses with less structure and lower interpersonal dialogue. In such cases, teachers' restrained presence (Vandergrift, 2002), namely the intention to promote learner autonomy in online learning, could be realised through the provision of learning materials and scaffolding in the asynchronous mode (Fujioka-Ito, 2013). The promotion of autonomy was also implemented in an included study (Brandl, 2012), which found more positive results from participants of optional tasks than those who completed the required tasks. Having said that, some participants who preferred teacher-directed learning might be inclined to favour the synchronous mode, and interpersonal dialogue might be facilitated by an increased physical and social presence in synchronous courses, which was found in the included study by Pérez (2003). Previous studies have also found that learners' level of persistence, self-control and self-learning capacity in DE are highly variable (e.g. Deimann & Bastiaens, 2010). Therefore, the findings corroborate the hypothesis that lower levels of TD could be achievable through combining asynchronous and synchronous complementarily, thus making the blended mode the preferred DE modality.

5.3 Research Question 3: Relationship between TD levels and effectiveness of DE modes

Discussion of the first and second research questions has laid the foundation for addressing the third research question: *'What is the relationship between levels of TD and effectiveness of the DE modes?*' Deriving from the analyses of results and findings, and the arguments propounded in relation to the former two research questions, it could be arguably inferred that an inverse relationship exists between the effectiveness of DE modes and the levels of TD.

According to the findings, the levels of TD were lowest whilst the positive results were apparently greatest in the blended mode, whereas the synchronous mode was associated with the highest levels of TD and least positive results. The levels of TD and positive results of asynchronous mode were in between the two other DE modes. These findings are consistent with the hypothesis that a high TD constitutes a barrier to learning in DE,

and thus a lower TD is correlated with positive results in terms of L2 learning, perception and attitudes, motivation and emotion of learners. The differentiations between the TD levels and results are also indicative of the consequential difference among the asynchronous, synchronous and blended modes, therefore lending support to the tripartite categorisation of DE modes.

It is worth noting that TD is the function of structure, dialogue and autonomy, and different compositions of the three variables could also lead to a low level of TD. For instance, a low level of autonomy for leaners preferring teacher-directed learning could be coupled with a higher dialogue between the teacher, thus resulting in a moderately low level of TD overall. A similar level of TD could also be achieved where the autonomy and structure are both high, so that learners might follow a highly structured curriculum independently, and engaging in dialogue with the teacher where necessary. Therefore, it could be argued that the actual combination of synchronous and asynchronous modes, use of media and technology and compositions of TD variables should be contingent on the types of learners (e.g. independent or teacher-dependent) and contexts (e.g. feasibility of sufficient synchronous interaction and complementarity of multiple media and technology).

While the current study suggests that positive results are commonly found in all DE modes, and especially in courses with lower TD levels and in combination of multiple media and technology, there is an absence of findings that discern the variations across different types of outcomes; a logical speculation is that DE effectiveness is mediated by the inter-relationships among L2 learning, perception and attitude, emotion and motivation. For instance, it has been argued that motivation, socialisation, information exchange and development of knowledge are interdependent in DE (Salmon, 2002, 2003). In a similar vein, the current findings have not provided any substantial evidence that distinguishes the types of L2 skills and levels of L2 proficiency. In other words, the affirmative findings in this study are incomplete, justifying further examinations to thoroughly address the third research question.

5.4 Summary of discussion

Based on the discussion of the three research questions, there is cogent evidence to associate DE modes with varying levels of TD, and to connect these characteristics with the effectiveness of DE courses. Although the findings are generally supportive of the hypotheses, the present study is exploratory and serves to present a possible direction to examining DE effectiveness. The remaining chapters highlight the limitations and implications of the current study, and put forward recommendations for future research.

6. Limitations

Due to the vastness of the literature in DE and SLL/FLL and the complexity of the subject, this study is intended to explore the applicability of the TDT in evaluating DE effectiveness. It should be underscored that there is no compelling evidence of any causal relationship between the variables investigated. In light of the complexity of SLL/FLL in DE, the current findings could also be oblivious of moderators and confounders.

6.1 Uncertainty of causation

The caveat of interpreting the apparently cogent relationship between TD levels and DE effectiveness is to establish any conclusive evidence of causation. Seemingly, the TD variables are intuitively sound explanations for achieving positive results in DE courses, but the association could be the result of other factors, such as a more rigorous planning of DE courses, the levels of training and digital literacy of teachers, and selective enrolment of more self-disciplined and motivated learners. Presumably, these mediating factors and others could be the underlying determinants of TD and DE effectiveness.

6.2 Review team

The review process was limited by the availability of reviewers and resources, and the composition of the review team might not be comprehensively represented and sufficiently versed in the subject matter (Macaro, 2020). As a result, the reviewer might have exhibited subjective biases in the measurement of TD levels, in spite of the use of an extensive guideline and crosschecking of measurements by two other checkers.

6.3 Moderators and confounders

It is possible that the outcome of DE could not be differentiated solely by the modes of DE, but should consider a myriad of moderating and confounding factors. This study has not examined the influence of the extensive range of variables (discussed in the literature

review: 2.3.2 Moderating variables) that might have influenced the effectiveness of DE. Comparing the modes of DE could be limited when individual differences are homogenised (Lockee et al., 2001), and overlooking contextual factors such as the cost and efficiency of DE (Clark, 1983; 1994a). Moreover, the choice of optimal media and technology should be grounded on understanding their nature (Harasim et al. 1995), appropriateness and purpose (Lou et al., 2006). It is arguable that "the most efficient medium would not necessarily be ideal for every stage of learning" (Cobb, 1997, p. 32), and the media and technology should befit the corresponding learners and contexts.

The findings obtained could have been influenced by a wider range of moderating and confounding variables that were not investigated, such as the content of the curriculum and the extent to which succeeding in the DE courses is significant to the participants. For instance, participants in a study were examined based their TOEIC scores, a high-stakes proficiency test (Chang, 2018), whereas the other studies were designed based on low-stake assessments or without any testing. Another moderator that could have affected learners' response and perception is the amount of previous exposure to DE, as indicated in previous studies (e.g. Platt et al., 2014). Moreover, the functionalities and accessibility of devices were not assessed, but could have impacted the learning experience and DE effectiveness, as adduced by other studies (Hao et al., 2021; Ng et al., in press). Hence, the validity of the present findings could only be validated on conditions of further examining the influence of moderators and confounders.

6.4 Assessment of TD

In fact, assessing DE effectiveness through the prism of TD framework had unaccounted for mixed and negative results of the blended mode (Lin & Fang, 2010; Moneypenny & Aldrich, 2018). These anomalies in the overall findings illustrate the need to broaden the scope of investigation in the subject matter. In this study, the scoring of variables was based on equal weighting and an assumption of linear relationships, which is a simplification of the TDT and would require empirical examination and validation. Furthermore, since most of the included studies were not experimental and did not

specifically measure TD and the learning results in a consistent and standardised manner, the findings of this systematic review might have provided a speculative connection between TD and DE effectiveness, but further research and examination are necessary to verify the nature of the relationship.

6.5 Survivorship bias

Another limitation is the potential of survivorship bias. The scope of this systematic review was confined to peer-reviewed studies published in academic journals for the purpose of maintaining the quality of research findings, but excluded other sources of research, such as doctoral theses and governmental reports on relevant empirical investigations. Nevertheless, non-published literature might also provide information that enhances the accuracy of the synthesised findings. Since there is a lower likelihood of publishing insignificant or indefinite findings (Macaro, 2020), the exclusion of doctoral theses might have led to an overrepresentation of positive findings in the current study.

6.6 Sustainability of outcome

Finally, there is a dearth of longitudinal studies to examine whether the outcomes of DE are longstanding or might dwindle over time. It is worth noting that in one of the included studies, half of the participants' L2 proficiency (Spanish) was below the benchmark standard after one-year of online learning (Aldrich & Moneypenny, 2019). As SLL/FLL is a prolonged process of learning, the actual effects of DE courses remain uncertain without charting participants' persistence and continual improvement over a more sustained period of time. All in all, the positive findings could be not causally connected to TD levels or DE modality, nor could this study prove that these variables possess any predictive power of yielding sustainable learning outcome.

7. Recommendations

To advance the present understanding of SLL/FLL in DE, validate and elucidate the significance of the current findings and resolve the limitations discussed, this chapter proposes recommendations on corresponding areas of further research and practical implications.

7.1 Future research

As elaborated in the chapters of discussion and limitations, there are numerous questions that remain unanswered and could be examined by future research. Firstly, the nature of relationships among the effectiveness of DE, TD levels and DE modality are yet to be ascertained. Secondly, the interrelationship among the variables of TD (structure, dialogue and autonomy) and the different permutations of variables could be elucidated. Depending on whether the variables and TD have synergistic effects or affect learning outcome orthogonally, the study and application of DE would be designed and implemented differently.

As this study has only classified the results of DE courses with three levels of outcome (i.e. positive, mixed and negative), follow-up studies could also investigate the magnitude of the results, and whether the strengths of correlation with TD variables and DE modes would be affected. Moreover, this study has identified the types of media and technology, without evaluating the content, delivery or instructional design of each type in detail. Hence, future studies could investigate these aspects of SLL/FLL courses in more depth. Furthermore, in view of the limited number of experimental and longitudinal studies found in this systematic review, further research could be designed in examine the possibility of causal relationships between DE modality, TD levels and DE effectiveness, and whether evidence exists to confirm their durability and extent of long-term results of DE courses. In addition, as discussed in the chapter on limitations, moderating and confounding variables might also influence the results of the DE, which should be subjected to rigorous empirical investigations. For instance, it is possible that language

use is moderated by technology (Chun et al., 2016), which should be examined further in the study of DE and SLL/FLL. Furthermore, there is an extensive range of outcomes investigated in other DE research but unexamined in the included studies, such as retention (e.g. Tinto, 1993) and course completion (Nash, 2005) (refer to literature review for details). Therefore, future research may identify and assess the wider ramifications of DE or lack thereof.

In the scheme of things, DE is a burgeoning but relatively small subset of the broader field of SLL/FLL. If DE becomes an increasingly mainstream form of SLL/FLL, especially when the number of new DE research mushrooms during and in the wake of the COVID-19 pandemic, the field might frequently intersect with other research areas of language teaching, such as motivation (e.g. Dörnyei & Schmidt, 2001; Dörnyei & Ushioda, 2013), learner strategy (e.g. Oxford, 2011), teaching reading and writing (e.g. Nation, 2009), individual differences of learners (e.g. Dörnyei, 2005), and other domains that are traditionally studied in the context of CI.

7.2 Practical implications

In theory, TD is a barrier to learning that could be reduced by decreasing structure, and increasing dialogue and autonomy. Nevertheless, based on the anecdotal evidence of the research team in teaching SLL/FLL and other subjects via DE, it is also sensible to postulate that a clear and well-organised course structure could provide clarity and possibly bolster learning, while excessive interpersonal dialogue might become superfluous if intrapersonal mental processes of learning is overlooked (Gorsky & Caspi, 2005). On the other hand, an emphasis on autonomy might be untenable for learners lacking the self-regulation or basic proficiency to be left to their own devices (Oxford, 1999; Zimmerman & Schunk, 2011). Hence, if course developers and instructors of DE explore the practical value of the current exploratory findings and attempt reducing TD through the blended mode, it is advisable to avoid indiscriminate generalisation and disregard the importance of other factors, such as the readiness of learners (e.g. L2 proficiency, personality, digital literacy), cultural differences, types of learning content,

previous learning experiences and expectation, and the contexts in which DE takes place. These factors were found to exert indirect influence on the results of the included studies. Previous literature has also pinpointed personal and learning characteristics as factors that might determine the success of DE learners (e.g. Boyd, 2004; Wang et al., 2008). Furthermore, more empirical evidence is needed to examine how asynchronous and synchronous modes should be combined in unison to optimise the effectiveness of the blended mode. In sum, TD levels should not be treated as the absolute barometer of DE effectiveness, and the axioms of ensuring suitability, feasibility and empirical-based applications should remain valid considerations in DE.

On account of the positive results in the study, the overall framework of TD reduction and blended courses might render promising development in DE pedagogy and instructional design. That said, the pursuit of DE effectiveness should take into account of the nuts and bolts of implementation, or might become lopsided when the benefits generated are not adequately measured against the costs involved, such as the additional financial expenses, time required for teachers' preparation, forgone opportunities for learners to apply their L2 skills in face-to-face settings that are probably more transferrable to physical interactions in real-life. The assumption of maximising DE effectiveness might not be invariably ideal; based on the principle of satisficing in language learning, it could be more practical and realistic to optimise an adequate level of proficiency that is attainable in a more cost-effective and efficient manner (Ferreira et al., 2002). It could be unfeasible or counterproductive to conduct DE courses in which the overt and implicit costs far outweigh the benefits achieved (Taplin & Brown, 2013).

8. Conclusion

8.1 Outcome of this study

As expounded in the literature review and further instantiated by this systematic review, the field of DE and SLL/FLL is complex and multidimensional, and its definitions, conceptualisations, theoretical development, practice are subject to the evolution or creation of de novo educational technology, advancement of instructional approaches and the unforeseen impact of the COVID-19 pandemic. In view of the increasing importance of DE in the recent decade, and the large-scale adoption of DE courses during COVID-19 pandemic, this study is intended to shed light on the extent to which SLL/FLL could be effectively delivered via DE.

Insofar as the scope of DE explored by this study, the findings could be considered as partial counterevidence to the findings of an early meta-analysis of DE, which concluded media and technology as merely tools “that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition" (Clark, 1983, p. 445). This study also reviewed the current state of knowledge and unified a well-grounded set of DE definitions, and canvassed an overarching categorisation of DE that transcends a single form of synchrony. Within the framework of TDT, this study lends support to all modes of DE, but suggests that blending asynchronous and synchronous in combination with multiple media and technology would most strongly associate with positive outcome of DE in SLL/FLL.

8.2 Relevance to stakeholders of DE

The findings of this study may exert an influence on the perspectives of stakeholders who are involved in shaping the future of DE and a renewed approach to education. According to Anderson and Elloumi (2004), DE “is a discipline that subsumes the knowledge and practice of pedagogy, of psychology and sociology, of economics and business, of production and technology” (p. xiii). Hence, it is highly likely that the role of DE in the

post-pandemic era would have a profound impact on the policy, research, pedagogies, and practice in the field of DE as well as the discipline of education as a whole (Williamson et al., 2020). The integral role of DE during the COVID-19 crisis has deservedly drawn an upsurge of interest from all stakeholders of education and society on a grand scale. The field of DE is under development and its future is likely to be reformulated by the global pandemic, inducing far-reaching implications that reverberate across policy-makers, researchers and academics, instructional designers, students, teachers, researchers educational institutions, instructional designers, policy makers, and other stakeholders of education.

8.3 Whither is DE beyond COVID-19?

In the era of COVID-19, some might perceive DE as the hallmark of educational progress, while others err on the side of conservatism. At this critical juncture, the present study has elucidated some of the theoretical and empirical issues that are connected with understanding the effectiveness of DE, thereby furnishing stakeholders of education with well-grounded information and suggestions that might guide the on-going development of DE, and possibly shaping the educational system at large. It is plausible that the future of DE could be reinvented by valuable insights gleaned from the pandemic. As the pandemic lingers on and a vastitude of questions remains unanswered, the jury is still out on the role of DE and it is unlikely that any study could be prescient of the future of education. Nonetheless, by systematically reviewing and synthesising a purposeful selection of studies from the extensive body of research in the field, this study and similar research might have a consequential impact on the development of DE in terms of the trajectory of theoretical development and research, and fleshed out some guidelines for harnessing the practice more effectively.

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Appendices

Appendix 1: Definitions of distance education (DE) (direct quotation in chronological order)

Authors	Definitions
Delling (1966)	"Distance education (Fernunterricht) is a planned and systematic activity which comprises the choice, didactic preparation and presentation of teaching materials as well as the supervision and support of student learning and which is achieved by bridging the physical distance between student and teacher by means of at least one appropriate technical medium" (p. 186).
Wedemeyer and Najem, (1969)	"could be combined to create a learning methodology more effective than any previously in existence. Students would be able to move largely at their own pace and go from area to area, course to course, as their needs matured. At no point in the sequence would opportunity be determined by such irrelevancies to personal learning as finding enough students to justify formation of a class" (Wedemeyer & Najem, 1969, p. 9)
Moore (1973)	"Distance teaching may be defined as the family of instructional methods in which the teaching behaviours are executed apart from the learning behaviours, including those that in a contiguous situation would be performed in the learner's presence, so that communication between the teacher and the learner must be facilitated by print, electronic, mechanical or other devices." (p. 664)
Peters (1973)	"Distance teaching/education…is a method of imparting knowledge, skills and attitudes which is rationalised by the application of division of labour and organisational

Authors	Definitions
	principles as well as by the extensive use of technical media, especially for the purpose of reproducing high quality teaching material which makes it possible to instruct great numbers of students at the same time wherever they live. It is an industrialised form of teaching and learning." (p. 206)
Peter (1973)	"Distance education is a form of indirect instruction. It is imparted by technical media such as correspondence, printed materials, teaching and learning aids, audiovisual aids, radio, television and computers. (p. 104)
Holmberg (1977)	"The term 'distance education' covers the various forms of study at all levels which are not under the continuous, immediate supervision of tutors present with their students in lecture rooms or on the same premises, but which, nevertheless, benefit from the planning, guidance and tuition of a tutorial organisation." (p. 9)
Holmberg (1981)	"implies that the character of good distance education resembles that of a guided conversation aimed at learning and that the presence of the typical traits of a conversation facilitates' (p. 210)
Garrison and Shale (1987)	Distance education is defined by three criteria, which "implies that the majority of the educational community between (among) teacher and students occurs non-contiguously", "involve[s] two-way communication between (among) teacher and students for the purpose of facilitating and supporting the educational process", and "uses technology to mediate the necessary two-way communication" (p. 11)
Bruder (1989)	"the application of telecommunications and electronic devices which enable students and learners to receive instruction from some distant location" (p. 30)

Authors	Definitions
Keegan (1990)	"the quasi-permanent absence of the learning group throughout the length of the learning process so that people are usually taught as individuals and not in groups, with the possibility of occasional meetings for both didactic and socialisation purposes. (p. 44)
Shale (1990)	"In sum, DE ought to be regarded as education at a distance. All of what constitutes the process of education when teacher and student are able to meet face-to-face also constitutes the process of education when teacher and student are physically separated." (p. 334)
Greenberg (1998)	"a planned teaching/learning experience that uses a wide spectrum of technologies to reach learners at a distance and is designed to encourage learner interaction and certification of learning" (p. 36).
Keegan (1996)	"Distance education is a form of education characterized by: • the quasi-permanent separation of teacher and learner throughout the length of the learning process (this distinguishes it from conventional face-to-face education); • the influence of an educational organization both in the planning and preparation of learning materials and in the provision of student support services (this distinguishes it from private study and teach-yourself programmes) • the use of technical media – print, audio, video or computer – to unite teacher and learner and carry the content of the course; • the provision of two-way communication so that the student may benefit from or even initiate dialogue (this distinguishes it from other uses of technology in

Authors	Definitions
	education); and • the quasi-permanent absence of the learning group throughout the length of the learning process so that people are usually taught as individuals rather than in groups, with the possibility of occasional meetings, either face-to-face or by electronic means, for both didactic and socialization purposes." (p. 50)
Moore & Kearsley (1996)	"DE is defined as "planned learning that normally occurs in a different place from teaching and as a result requires special techniques of course design, special instructional techniques, special methods of communication by electronic and other technology, as well as special organizational and administrative arrangements" (p. 2).
Moore (1997a)	'distance education is not simply a geographic separation of learners and teachers, but, more importantly, is a pedagogical concept. It is a concept describing the universe of teacher-learner relationships that exist when learners and instructors are separated by space and/ or by time." (p. 22)
Jung (2001)	"Distance education, like any other educational method, is a method by which a learner engages in some form of communication with a teacher in order to acquire new information, transform that information into knowledge, and develop skills in using that knowledge in various contexts. " (p. 532)

Authors	Definitions
Moore & Kearsley (2012)	"In distance education, technology is the sole or principal means of communication" (p. 3) "What makes a distance education course is not its technology. What is common to every course is—as we said before—that it has both learners and a teacher, content organized around a set of learning objectives, some designed learning experiences, and some form of evaluation." (p. 6)
Holmberg (2003)	"distance education brings about one-to-one relations, each student interacting personally with his/ her tutor. This one-to-one relation between learner and teacher is exceptional in education, probably elsewhere known practically only in traditional Oxford and Cambridge tutorials." (p. 14)
Bernard et al. (2004)	In distance education, "media may transform the learning experience in ways that are unanticipated and not regularly available in face-to-face instructional situations." (p. 4)
Perraton (2007)	"an educational process in which a significant proportion of the teaching is conducted by someone removed in space and/or time from the learner" (p. 12)
Appana (2008)	"Distance education is a formal learning activity, which occurs when students and instructors are separated by geographic distance or by time. Learning is supported by communications technology such as television, videotape, computers, email, and mail." (p. 5)
Hassenburg (2009)	"Distance education is any form of learning in which the teacher is not present at the same time or place as the student." (p. 7)
Schlosser & Simonson (2010)	"institution-based, formal education where the learning group is separated, and where interactive

Authors	Definitions
	telecommunications systems are used to connect learners, resources, and instructors" (p. 1).

Appendix 2: Definitions of media and technology in DE

Media and technology	Definition
Asynchronous communication	"A type of communication that can occur at any time and at irregular intervals" (Simsonson & Seepersaud, 2019, p. 63)
Asynchronous online learning	"Asynchronous online learning is an educational model in which learners participate in Internet-based learning opportunities on their own schedules." (Mackey, 2016, p. 120)
Audio-conferencing	"[E]ducational audio conferencing [could be defined] as using the telephone to link distant learners with each other and with an instructor" (Moore, 1994b, p. 1)
Blogs (weblogs)	"A weblog (or 'blog') can be thought of as an online journal that an individual can continuously update with his or her own words, ideas, and thoughts through software that enables one to easily do so." (Campbell, 2003, p. 1)
Correspondence course	"[C]orrespondence courses required students to complete a series of lessons through self-study, usually with only a single textbook or small set of readings, returning each lesson through the mail for grading by the instructor. Correspondence students typically worked through their courses at their own pace over a longer period of time than a traditional semester-based course, sometimes up to a year or even an unlimited period of time." (Gigantino, 2016a, p. 267)

Media and technology	Definition
Educational technology	"Educational technology has a long history. It developed from still visual media to visual audio motion video media. Technological developments encouraged the use of radio and television as tools of educational technology. By the late 1980s, however, the term educational technology had become synonymous with computers and Internet connectivity." (Avila, 2016, p. 386)
E-learning / elearning / e-learning	"Elearning is a combination of methods, structures and networked electronic tools orchestrated into systems that bring about, or are intended to bring about, learning." (Dron & Anderson, 2019, p. 537)
Learning Management Systems	"A learning management system (LMS) is an educational software tool that is designed to provide a comprehensive, seamless, and safe virtual environment in which learning can take place. It can be of use in a face-to-face, blended, or fully asynchronous learning scenario." (Nash, 2016b, p. 649)
Moodle	"Modular object-oriented dynamic learning environment (Moodle) is a free, open source learning management system (LMS). Moodle is thus a tool that one can use to teach others using computers, either on a freestanding computer or through networked computers, including those connected to the Internet." (Carson, 2016, p. 773)
Podcast	"In its simplest form, a podcast is a digital audio recording. This audio recording can be created in multiple ways, can be stored and distributed through a variety of mechanisms, and can be used for many purposes...There are multiple ways to use podcasts in online learning. Podcasting can be used by the instructor for content delivery, such as in a lecture, or a lecture recovery, where a class session is recorded to make it

Media and technology	Definition
	available for students who were unable to attend the actual event. A podcast can also be used to provide remediation, enrichment, or differentiated instruction for students. A podcast can be used by an instructor to provide individualized feedback to a student as a way to improve learning outcomes, maintain motivation, and increase perceptions of teaching presence in an online class. Microlectures—short, focused presentations formatted for consumption on mobile phones or other mobile devices—can be an example of this sort of use. Podcasting is also useful as a student tool for learning, where students create podcasts to engage in the course content or to provide a tangible artifact that represents their learning in a specific area in an online class." (Newberry, 2016, p. 902)
Social media	"The term social media is defined as technology that allows virtual interaction among users, who are often members of a web-based community. The term social networking is synonymously used to describe the use of this technology to connect with others who have similar interests. Social media is one category of technology that has found widespread use in the context of online education. While these tools were not necessarily developed with education applications in mind, they have been put to practical use in a range of communication, collaboration, and connection tasks in online higher education, and new platforms continue to emerge. " (Venable, 2016, p. 1018)
Synchronous formats of online learning	“[S]ynchronous, meaning occurring in real time…can be distant geographically and allow users to connect easily with others around the world.” (Distefano et al., 2004, p. 1)

Media and technology	Definition
Videoconferencing	"Videoconferencing, or a live connection between two or more persons or a group of people located at different locations for the purpose of communication or interaction, is an essential part of many forms of online education. In the online classroom, there can be both asynchronous (where the instructor and students do not need to be online at the same time) and synchronous (directly interactive) instruction. Live streaming videoconferencing makes synchronous learning models possible and makes online education more accessible. Communication technologies enable students and educators to connect, collaborate, and share their knowledge regardless of the physical distance. Videoconferencing can be an effective means of communication for interactive teaching and learning in online education. This facilitates relevant and authentic learning opportunities for students who pursue online education. The participants only need to invest in some relatively inexpensive devices such as a webcam and headset, if such hardware is not already built in to their computers, in order to participate in a videoconference. Much of the necessary software is available free of cost, and most online universities have accounts with the best known videoconferencing platforms, such as GoToMeeting, Adobe Connect, Microsoft Live Meeting, and Zoom. The dramatic reduction in the cost of videoconferencing has enabled more institutions to take advantage of the technology, which can increase productivity, collaboration, and communication." (Dhamdhere & Danver, 2016b, p. 1163)

Media and technology	Definition
Web-based instruction (WBI)	"Web-based instruction (WBI) can be viewed as an innovative approach for delivering instruction to a remote audience using the Web as the medium. According to Smith and Ragan (1993), 'Instruction is the delivery of information and activities that facilitate learners' attainment of intended, specific learning goals' (p 2) and the medium is the physical means by which the instructional message is communicated." (Khan, 1998, p. 63)
Web conferencing	"Web conferencing is the use of an online software or service that allows participants a range of interactions with a set of tools in a virtual meeting environment in real time. This type of technology has multiple uses in online education, including for the transmission of synchronous class sessions, lectures, and discussions; for online office hours; and as a method for enabling students to study or otherwise work together in groups. Tools can include video transmission, a whiteboard, and whiteboard writing and editing tools, Slideshow/SlideDeck displays, polling, recording, voice over Internet transmission, and chat. Some services also connect voice through an external phone line. Adobe Connect, WebEx, GoToMeeting, and Blackboard Collaborate are commonly known brand names of Web conferencing providers. Skype and Google Hangouts also support Web conferencing at no cost." (Bedard-Voorhees, 2016, p. 1184)
Webminar	"Webinars…use video-conferencing technologies that enable direct interaction to occur between participants and their lecturers without the need for them to be in the same physical location" (Ebner & Gegenfurtner, 2019, p. 2)

Media and technology	Definition
Web 1.0	Static presentation of information via the internet (O'Reilly, 2005)
Web 2.0	Social networking and user content generation (O'Reilly, 2005)

Appendix 3: Related terminologies of DE

Terms	Definitions
Computer-Assisted Instruction (CAI)	"Computer-assisted instruction (CAI), also referred to as computer-based instruction, computer-based education, and computer-assisted learning, is a process that involves instruction using the computer, often in ways that allow the student to interact with the instructional materials and allow for monitoring the student's learning." (Burnett, 2013, p. 229)
Computer-mediated communication (CMC)	"Computer-mediated communication (CMC) is communication between people using computer technology as the medium, or interface, for that communication. It can work either synchronously, or in real-time applications such as open chat rooms or audio/video over the Internet, or asynchronously—that is, in time-delayed applications such as e-mail, online discussion forums, and blog comments." (Hopperton, 2016, p. 235)
Online learning	"[t]he use of the Internet to access learning materials; to interact with the content, instructor, and other learners; and to obtain support during the learning process, in order to acquire knowledge, to construct personal meaning, and to grow from the learning experience. (Ally, 2004, p. 7)"

Terms	Definitions
Distributed learning	"Distributed learning is a broad label that applies to any sort of education in which the learner and the instructor are separated by time and/or geography for all or part of the course." (Hopperton, 2016, p. 351) "[D]istributed learning, characterizing its availability at any place and any time." (Moore & Kearsley, 2012, p. 2)
Intelligent Computer-Assisted Language Learning (ICALL)	ICALL is "the subfield of CALL integrating natural language processing and artificial intelligence" (Amaral & Meurers, 2008, p. 323)
Open learning	Open learning is defined as "an organised educational activity, based on the use of teaching material, in which constraints on study are minimised either in terms of access, or of time and place, pace, method of study, or any combination of these" (Perraton, 2006, p. 12).
Flexible or open learning	"Open learning is flexible, negotiated and suited to each person's needs. It is characterized by open entry–open exit courses, and the courses begin and end when the student is ready" (Gunawardena & McIsaac, 2004, p. 358)

Terms	Definitions
Microlearning	"Microlearning is based on traditional education practices of dividing subjects into small sections to learn over the duration of a term, quarter, or semester. The traditional methodology of microlearning has been adapted to online higher education to consist of modules in courses. Microlearning has become the foundational instruction method and design for many online educators. Online and hybrid courses, which combine online and face-to-face learning, use microlearning to integrate online instructional media and tools into the curricula. One online course may be adapted for many students in various settings, which requires accommodation of the technology so that a broad subject is taught in a logical and procedural manner." (Spann, 2016, p. 751)
Mobile learning	"Mobile learning, or m-learning, is the use of mobile devices such as laptops, smartphones, and tablets to enhance learning...Mobile learning is an approach to learning in informal and formal settings for business, distance education, and personal enjoyment. M-learning can also be characterized as an anywhere, anytime mode of learning. Mobile learning allows education to be more convenient and accessible." (Handley, 2016, p. 771)

Terms	Definitions
Self-Paced Study	"Self-paced courses usually require students to complete portions of the course or the entire course on their own. Self-study can be similar to correspondence study, with each assignment returned through the mail for grading by the instructor or returned in person in a part face-to-face course. Students typically study at their own pace over a longer period of time than for a traditional course, which allows students flexibility to complete work for academic credit outside of the traditional, semester-based classroom, which requires regular attendance." (Gigantino, 2016b, p. 998)

Appendix 4: Generations, synchrony and media and technology in SLL/FLL

Generation	Media and technology	Synchrony
First generation (since 1880s): • 'Correspondence study' (Moore & Kearsley, 2012) • 'Correspondence Generation' (Garrison, 1985) • 'The Correspondence Model' (Taylor, 2001)	**Correspondence** • University teaching by mail (Bittner & Mallory, 1933) • Correspondence course (e.g. Bååth, 1973, 1980) *Examples of SLL/FLL:* • Spanish as a FL (Peers, 1945)	Asynchronous
Second generation: • 'Broadcasting' (Moore & Kearsley, 2012) • 'Telecommunications Generation' (Garrison, 1985) • 'The Multi-media Model' (Taylor, 2001)	**Audiotape** (e.g. Cryer & Kaikumba, 1987; Kelly & Ryan, 1984; Logan et al., 1976) *Examples of SLL/FLL:* • Audio and video recording of language teaching (Garrett, 1991)	Asynchronous
	Videotape	Asynchronous
	Radio (e.g. Jaminson & McAnany, 1978)	Asynchronous
	Multimedia • Televised instruction (e.g. Carpenter & Greenhill, 1955, 1958; Greenhill et al., 1956; Twyford, 1956) • Instructional TV (Curtis & Biedenbach, 1979) • Educational TV (e.g. Unwin & McAleese, 1988) *Examples of SLL/FLL:* • Audio and video recording of language teaching (Garrett, 1991)	Asynchronous

Generation	Media and technology	Synchrony
Third generation: • 'Systems Approach' (Moore & Kearsley, 2012) • 'The Telelearning Model' (Taylor, 2001) • 'Computers Generation' (Garrison, 1985) • Computing and telecommunications (Nipper, 1989; Thorpe, 2006)	**Computer assisted learning (CAL)** (e.g. Kearsley et al., 1983) *Examples of SLL/FLL:* • Digitally record speech corpus (Campell et al., 2007) • Computer-aided pronunciation (CAP) (Pennington, 1999; Tsubota et al., 2004) • CALL (Bax, 2003) • Tutorial CALL (Hubbard & Bradin Siskin, 2004) • CALL training (Hubbard, 2004; Hubbard & Levy, 2006) • CALL FL listening (Frommer, 2006) and writing (New, 1999) • Electronic dictionaries (Breidt & Feldweg, 1997; Born, 2007) • Linguistic computing (Cobb, 2007) • Digitally record speech corpus (Campell et al., 2007) • Computer-aided pronunciation (CAP) (Pennington, 1999)	Asynchronous / Blended
	Email (e.g. Hassett et al., 1995; Updegrove, 1991) *Examples of SLL/FLL:* • Email and FL study and instruction (Lunde, 1990) • Voice emailing (Volle, 2005)	Asynchronous
	Institutional DE (Moore, 1987; Ross, 1976) • Articulated Instructional Media Project (AIM) (Wedemeyer & Najem, 1969) • Open universities (e.g. Wagner, 1972) • Open and distance teaching universities (ODL) (e.g. Rumble & Harry, 1982; Raza, 2008) • Dual-mode universities (Keegan, 1986) • Flexible-pacing external education programme (e.g. McDonald et al., 1981) *Examples of SLL/FLL:* • Language Online Project of Carnegie Mellon University (Chenoweth et al., 2006) • Teaching less commonly taught languages (LCTLs) (Fleming et al., 2002) • Virtual public schools (Oliver et al., 2012)	Asynchronous / Blended

Generation	Media and technology	Synchrony
Fourth generation: • 'The Flexible Learning Model' (Taylor, 2001); • 'Teleconferencing' (Moore & Kearsley, 2012) • Interactive internet-based communication	**Computer mediated communication (CMC) interaction** (e.g. Wang, 2004) *Examples of SLL/FLL:* • Virtual self-access centre (Chan & Kim, 2004) • E-talk (Beauvois, 1994) • Micropublishing (Murray & Hourigan, 2006) • Voice-based CMC (Alastuey, 2011)	Synchronous
	Audio teleconferencing (e.g. Olgren & Parker, 1983) and videoconferencing (e.g. Garrison, 1989, 1997) *Examples of SLL/FLL:* • EFL telecollaboration (Taşkıran, 2019)	Synchronous
	Interactive multimedia (IMM) (e.g. Mishra & Sharma, 2005) *Examples of SLL/FLL:* • Integrated and internet-based interactive grammar learning (Bick, 2005) • Multimedia English Corpus (Ackerley & Coccetta, 2007) • Multimodal online grammar resource (Hegelheimer, 2006) • Interactive web-based EFL writing (Wible et al., 2001) • Intelligent Web-based Interactive Language Learning system (IWiLL) (Kuo et al., 2002) • Telecollaborative practice for teaching Chinese (Luo & Yang, 2018)	Synchronous / asynchronous / blended
	Internet audio-conferencing (e.g. audio chatrooms; Skype) *Examples of SLL/FLL:* • Distance language courses (Hampel & Hauck, 2004) • Voice chatroom (Jepson, 2005) and dialogue system (Stewart & File, 2007) • Skype-based language learning (Mullen et al., 2009)	Synchronous
	Internet videoconferencing (e.g. Peterson, 2004) *Examples of SLL/FLL:* • L2 oral development (Payne & Ross, 2005; Payne & Whitney, 2002)	Synchronous

Generation	Media and technology	Synchrony
	Written interaction • Chatroom (e.g. MSN) *Examples of SLL/FLL:* • Real-time chatting between native-speaker (NS) and nonnative-speaker (NNS) (Okuyama, 2005; Tudini, 2003) • Internet relay chat (IRC) (Xie, 2002) • Written chat (Sykes, 2005)	Synchronous
Fifth generation: • 'Computer- and Internet-based Virtual Classes' (Moore & Kearsley, 2012) • 'The Intelligent Flexible Learning Model' (Taylor, 2001);	**Web 2.0** (O'Reilly, 2005) • Threaded discussion (e.g. Ioannou & Artino, 2009) • Blogs (e.g. Aydin, 2014; Özdemir & Aydin, 2015) • Wiki (e.g. Deters et al., 2010; Ioannou & Artino, 2009; Zheng et al., 2015) *Examples of SLL/FLL:* • Online writing and editing (Godwin-Jones, 2008a) • Digital writing support (Knight et al., 2020; Strobl et al., 2019) • Blog for developing writing fluency and lexical complexity (Fellner & Apple, 2006) • Audioblog (Hsu et al., 2008) • Podcast (McCarty, 2005; Rosell-Aguilar, 2007) • Web-blog (Bloch, 2007; Trajtemberg & Yiakoumetti, 2011)	Blended
	Social media • Facebook (Aydin, 2012; Kabilan et al., 2010; Sánchez et al., 2014; VanDoorn & Eklund, 2013) *Examples of SLL/FLL:* • Social media for collaborative language learning (Kessler, 2013; Mondahl & Razmerita, 2014)	Blended
	Learning management systems (e.g. Yueh & Hsu, 2008)	Blended

Generation	Media and technology	Synchrony
Latest trends	**Artificial intelligence** (e.g. Ally, 2019) *Examples of SLL/FLL:* • AI language error correction (Dodigovic, 2005) • Intelligent CALL (ICALL) (Amaral & Meurers, 2008, 2011; Meurers, 2012) • The Language Muse Activity Palette (Burstein & Sabatini, 2016) • Adaptive reading (Chen & Meurers, 2019) • Grammatical error correction (Chollampatt & Ng, 2018) • Chatbox for EFL (Coniam, 2008)	Blended
	Virtual teacher *Examples of SLL/FLL***:** • Virtual tutor (Engwall, 2006; Engwall & Balter, 2007)	Blended
	Virtual reality / augmented reality (e.g. Hedberg & Alexander, 1994; Helsel, 1992)	Blended
	Virtual worlds (e.g. Dickey, 2005a) *Examples of SLL/FLL:* • Second life in language learning (Aydin, 2013; Stevens, 2006)	Blended
	Gamification (e.g. Dondlinger, 2007; Garland, 2015) *Examples of SLL/FLL:* • Synthetic immersive environment (Sykes et al., 2008) • 3-D virtual game-like language learning (Berns et al., 2013)	Blended
	Mobile learning (e.g. Cochrane, 2013) *Examples of SLL/FLL:* • Language learning mobile applications (Godwin-Jones, 2008b) • SMS (Levy & Kennedy, 2005) • Vocabulary learning (Stockwell, 2007) • M-learning for L2 learning (Thornton & Houser, 2002) • MALL (Kondo et al., 2012)	Blended
	MOOC (e.g. Dziuban & Picciano, 2015) *Examples of SLL/FLL:* • Language MOOC (Bárcena & Martín-Monje, 2014)	Blended

Appendix 5: Summary of studies in DE of SLL/FLL since 2000

Skills	**Examples of SLL/FLL research**	**Media and technology (synchrony*)**	**Measurements**
Listening	O'Bryan & Hegelheimer (2007); Absalom & Rizzi (2008)	Podcasting (A); online listening tasks (A)	• Students' and teachers' attitude • Retention of learning
Speaking	Huang & Hung (2009); Mompean & Fouz-González (2016); Mork (2009); Deutschmann et al. (2009); Blake et al. (2008); Kenyon and Malabo (2001); Hung & Huang (2015); Cunningham (2019); Rezai & Zafari, 2010); Tahriri et al. (2015); Ostanina-Olszewska (2018); Rezai & Zafari (2010)	Twitter (A) Second-life (B) CD and DVD (A) Voice-over Internet protocol (VoIP) sound exchange (S) Video blog (A) Synchronous computer-mediated communication (SCMC) (S)	• Oral proficiency • Attitude, attention, integration of knowledge, motivation
Reading	Murphy (2010); Abraham (2008)	Web-based collaborative reading exercises (A) Computer-mediated glosses (A)	• Comprehension scores; reading comprehension; vocabulary learning
Writing	Lee (2010); Bloch, (2007); Armstrong & Retterer (2008); Godwin-Jones (2003); Sun & Chang (2012); Such (2019); Hung & Young (2015); Al Qunayeer (2020); Pellet (2012); Fidaou et al. (2010)	Weblog, wikis, e-reader, Facebook (A)	• Participation, friendship, sense of community; development of content language
Grammar	Pellettieri (2000); Enkin & Mejías-Bikandi (2017)	Chatting (Network-based communication (NBC)) (S)	• Grammatical competence

Skills	Examples of SLL/FLL research	Media and technology (synchrony*)	Measurements
Vocabulary	Reynolds & Taylor (2020)	Mobile-assisted language learning (MALL) (B)	• General L2 learning
Multiple	Noytim (2010); Hampel et al. (2012); Chen & Yang (2014); Rinekso & Muslim (2020); Lamb & Arisandy (2019); Fitria (2021); Despain (2008); Nielson (2011); Ushida (2005); Janfeshan & Janfeshan (2021); Huang & Hung (2013); Bradley et al. (2010); Kraemer (2008b)	Weblog (S) Videoconferencing (S) Online forums, weblogs, Skype, and email, synchronous online discussion (S) Online informal learning of English (B) Zoom, Live YouTube (S) Self-study software (A) Social network (B) Video-based online discussion forum (S) Wikis (A)	• Motivation; student perception of effectiveness; achievement, attrition rate; attitude; user-content generation; self-perceived confidence, motivation, and language skills

** A = asynchronous; S = synchronous; B = blended*

Appendix 6: Quality assessment form and parameters of rating

WEIGHT OF EVIDENCE	
Relevance (high/medium/low/unspecified) Does the focus of this study match what we intend to do in this review? (Is the topic relevant?)	
Appropriateness (high/medium/low/unspecified) Is the design and analysis suitable in addressing the questions, or sub-questions, of this specific systematic review? (Is the design relevant?)	
Contribution (high/medium/low/unspecified) Does the study answer the question/s of this specific systematic review and help inform knowledge of distance education? (Does it add to knowledge?)	
Trustworthiness Taking account of all quality assessment issues, can the study findings be trusted to answer its research questions? (Can we trust its findings?) (yes, no, somewhat)	
Overall WOE (high/medium/low/unspecified)	
VERIFICATION	
Is the WOE in line with the result of EPHPP? (for quantitative studies) (yes, no, somewhat)	
Is the WOE in line with the result of the CASP systematic review checklist (for qualitative studies)? (yes, no, somewhat)	

Adapted from the extraction grid of Rose et al. (2021), EPHPP (1998) and CASP (2018)

Appendix 7: Data extraction form

PAPER INFORMATION	
Author	
Title	
Year	
Paper type	
FIRST CHECK	
Are there sufficient contextual details to be analysed by the transactional distance theory? (yes/limited/no)	
ABSTRACT	
Does the abstract provide sufficient information to understand the study?	
INTRODUCTION/GENERAL	
What topic did the study investigate?	
Who does the study investigate? (Teachers/learners)	
In which country/region was the study carried out?	
Level of education	
LITERATURE REVIEW	
Which other theories are drawn upon?	
Any other core constructs?	
METHODOLOGY	
Are the research questions clearly stated? (yes, no, somewhat)	
What, broadly, is the methodology adopted? (quantitative/qualitative/mixed?)	
What is the research design?	
Cross-sectional/longitudinal?	
(If applicable) What is the independent variable? (things being manipulated)	
If applicable, what is the dependent variable? (things being measured?)	
What was the actual sample?	
What was the sample size?	

What was the first language?	
What was the second/foreign language?	
What was the type/skill of L2 learning?	
What were the media and technology in the asynchronous course? (if applicable)	
What were the media and technology in the synchronous course? (if applicable)	
What were the media and technology in the blended course? (if applicable)	
DATA COLLECTION	
What were the data collection instruments?	
Did data collection seem reliable?	
How were data analysed?	
Does this seem like a reliable/valid way of analysing the data?	
RESULTS	
What are the actual results?	
Do their conclusions match your assessment of the findings/results?	
CONCLUSIONS/IMPLICATIONS	
What limitations of the study are discussed?	
What is the main implication?	
Briefly, what are suggestions for future research (if stated)?	

Developed by the author, and adapted from the extraction grid of Rose et al. (2021)

Appendix 8: Items for measuring transactional distance (TD)

I. PAPER INFORMATION	
Author	
Title	
Year	
Paper type	

II. TRANSACTIONAL DISTANCE VARIABLES	
A. Structure	Yes/Somewhat/No/Not indicated in the paper
Learner-content	
Is the course content interesting and appropriate to the students?	
Do students know how much time they should spend on each activity?	
How rigid or flexible is the content or curriculum?	
Learner-interface	
Are student inhibited from participating?	
Is it easy for students to get information about the DE classes?	
Are students comfortable with using the media and technology?	
Do students use a variety of media?	
Are the digital media easy to use?	
Overall level of structure (high/medium/low)	
B. Dialogue	Yes/Somewhat/No/Not indicated in the paper
TDSI (Transactional Distance between Students and Instructor)	
Does the instructor frequently interact with the students?	
Is there plenty of opportunities and time for interaction?	

Does the instructor pay attention to the students?	
Overall, is there a sufficient level of interaction?	
Do students pay attention to the interaction between the instructor and the students?	
Does the instructor challenge the students to study well?	
Is there an emotional distance between the instructor and the students?	
Is the instructor available to help the students?	
Is the instructor dependable?	
Is the instructor empathetic?	
Is the instructor non-intrusive?	
TDSS (Transactional Distance between Student and Students)	
Do students interact and learn together?	
Do students challenge one another to study well?	
Do students pay attention to the interaction among other student? (vicarious interaction)	
Is there an emotional distance among the students?	
Is there a sense of membership among the students?	
Are the students available to help the students?	
Are the fellow students dependable?	
Are the fellow students empathetic?	
Are the fellow students non-intrusive?	
Overall level of dialogue (high/medium/low)	
C. Autonomy	Yes/Somewhat/No/Not indicated in the paper
Do students learn well when they study alone?	
Are students responsible for meeting their learning goals in class?	
Do students find additional resources outside of class?	

Do students rely on instructors to learn?	
Are students in control of what they are learning?	
To what extent are learners self-regulated and directing own learning?	
Overall level of autonomy (high/medium/low)	
Overall Transactional Distance	Yes/Somewhat/No/Not indicated in the paper
Do students feel close to the instructor?	
Do students feel close to other students?	
Do students have a sense of community?	
Do students and the instructor(s) have a positive relationship?	
Do students have a positive relationship?	
Do students understand the goals and activities of the course?	
Are students engaged in the learning process?	
Could students meet their learning goals for the class?	
Overall level of TD (high/medium/low)	

Developed by the author and adapted from instruments in empirical studies of TD (Chen & Willits, 1999; Huang et al., 2015; Lane, 2017; Macaskill & Taylor, 2010; Paul et al., 2015; Zhang, 2003)

Appendix 9: Overview of the included studies

Background information	**Number / range**	**Remark**
Included studies	31	
Dates of publication	2000 – 2020	Median: 2015
Sample sizes	13 – 1,025	Mean: 98.6
Length of studies	6 weeks – 2 years	

Appendix 10: Research design of the included studies

Research design	**Number of studies**	**Percentage**
Cross-sectional	17	55%
Longitudinal	1	3%
Experimental	4	13%
Quasi-experimental	9	29%
Total	31	100%

Appendix 11: Types of data collection of the included studies

Data collection	**Number of studies**	**Percentage**
Mixed	18	58%
Qualitative	6	19%
Quantitative	7	23%
Total	31	100%

Appendix 12: Lengths of empirical investigations in the included studies

Length of empirical investigations	**Number of studies**	**Percentage**
Less than three months	7	23%
1 term / semester	17	55%
2 terms / semesters	1	3%
1 academic year	2	6%
Between 1 and 2 academic years	2	6%
2 academic years	1	3%
Not specified	1	3%
Total	31	100%

Appendix 13: Years of publication of the included studies

Periods of publication	**Number of studies**	**Percentage**
2000-2004	3	10%
2005-2009	5	16%
2010-2014	7	23%
2015-2019	10	32%
2020	6	19%
Total	31	100%

Appendix 14: Number of countries / regions conducted in the included studies

Country / region	**Number of studies**	**Percentage**
Chile	1	3%
Colombia	1	3%
France	1	3%
Indonesia	2	6%
Iran	2	6%
Japan	1	3%
Jordan	1	3%
Oman	1	3%
Pakistan	1	3%
South Korea	2	6%
Taiwan	3	9%
The Netherlands	1	3%
Turkey	2	6%
UK	2	6%
USA	13	37%
Vietnam	1	3%
Total	35	100% *(Rounding errors removed)*

Appendix 15: Number of settings in the included studies

Setting	**Number of studies**	**Percentage**
University	26	84%
Higher education / college / pre-university	4	13%
Language institution	1	3%
Total	31	100%

Appendix 16: Types of participants in the included studies

Type of participants	Number of studies	Percentage
High school students	1	3%
College / pre-university students	4	11%
Undergraduates	26	68%
Postgraduates	2	5%
Language teachers / tutors	3	8%
Pre-teachers / teacher trainees	2	5%

Appendix 17: Sample sizes of the included studies

Sample size	**Number of studies**	**Percentage**
Less than 50 participants	15	48%
51 to 100 participants	9	29%
100 to 150 participants	2	6%
151 to 200 participants	2	6%
201 to 250 participants	1	3%
251 to 300 participants	1	3%
More than 301 participants	1	3%
Total	31	100%

Appendix 18: L1s and L2s of the included studies

	L1		L2	
Language	**Number of studies**	**Percentage**	**Number of studies**	**Percentage**
Arabic	2	4%	-	-
Chinese	5	11%	1	3%
Dutch	1	2%	-	-
English	10	22%	17	55%
Farsi	2	4%	-	-
French	2	4%	1	3%
German	-	-	5	16%
Greek	1	2%	-	-
Indonesian	3	7%	-	-
Japanese	2	4%	3	10%
Korean	5	11%	-	-
Polish	1	2%	0	-
Russian	1	2%	-	-
Spanish	3	7%	4	13%
Turkish	2	4%	-	-
Urdu	1	2%	-	-
Vietnamese	1	2%	-	-
Unspecified / multiple	4	9%	-	-
Total	46		31	

Appendix 19: Levels of L2 courses in the included studies

Level of L2 courses	**Number of L2 courses**	**Percentage**
Novice	2	6%
Elementary	5	16%
Elementary to intermediate	3	10%
Intermediate	9	29%
Advanced	2	6%
Various	5	16%
Unspecified	5	16%
Total	31	100%

Appendix 20: Summary of L1s, L2s, L2 skills, levels and sample sizes (N)

Included studies	L1(s)	L2(s)	L2 skill(s)	L2 level(s)	N
Abrams (2003)*	English	German	speaking	intermediate	96
Abuseileek and Qatawneh (2013)***	Multiple (unspecified)	English	speaking	elementary to intermediate	30
Arnold (2007)	English	German	speaking	intermediate	56
Bailey, Almusharra and Hatcher (2020)	Korean	German	general	elementary to intermediate	186
Brandl (2012)	English	German	general	novice	86
Brick (2012)	English, French, Spanish, Greek	German	general	various	15
Chang (2018)	Korean, Japanese	English	general	intermediate	53
Chang (2009)	Chinese	English	writing	intermediate	30
Fujioka-Ito (2013)	Unspecified	Japanese	general	intermediate	18
Gonzalez Moreno (2011)	Spanish	English	general	unspecified	20
Hauck (2007)	English, French	English, French	general	various	25
Hirotani (2009)	English, Chinese, Korean	Japanese	speaking	novice	18
Huang (2020)†	Multiple (unspecified)	Chinese	general	elementary	13

Included studies	L1(s)	L2(s)	L2 skill(s)	L2 level(s)	N
Jauregi and Banados (2008)	Dutch	Spanish	general	advanced	40
Jayaron and Mohammed (2016)	Arabic	English	writing	elementary	56
Karaaslan, Kilic, Guven-Yalcin and Gullu (2018)	Turkish	English	vocabulary	intermediate	45
Khodaparasta and Ghafournia (2015)	Farsi	English	vocabulary	intermediate	120
Kocdar, Karadeniz and Goksel (2018)	Turkish	English	general	unspecified	179
Kusumawati (2020)	Indonesian	English	speaking	unspecified	96
Lin and Fang (2010)	Chinese	English	speaking	intermediate	96
Marcum and Kim (2020)	Multiple (unspecified)	English	speaking	elementary to intermediate	56
Marull and Swapna (2020)	English	Spanish	speaking	elementary	297
Mellati, Khademi, and Abolhassani (2018)	Farsi	English	vocabulary	intermediate	90
Moneypenny and Aldrich (2018)	English	Spanish	speaking	novice to intermediate	108
Nguyen (2011)	Vietnamese	English	general	various	30

Included studies	L1(s)	L2(s)	L2 skill(s)	L2 level(s)	N
Pérez (2003)	English	Spanish	writing	elementary	24
Perveen (2016)	Urdu	English	general and technical business English	unspecified	1025
Riwayatiningsih and Sulistyani (2020)**	Indonesian	English	writing	unspecified	55
Sato, Chen and Jourdain (2017)	Chinese, English, Korea, Indonesian	Japanese	general	elementary	26
Shang (2017)	Chinese	English	writing	various	44
Sotillo (2000)*	Arabic, Japanese, Korean, Polish, Russian, and Spanish	English	writing	advanced	25

Appendix 21: Numbers of L2 courses according to DE modes

DE mode	Number of L2 courses	Percentage
Asynchronous mode	16	32%
Synchronous mode	16	32%
Blended mode	18	36%
DE modes of all courses	50	100%

Appendix 22: Numbers of media and technology applications categorised by DE modes

Media and technology	**Number of applications**	**Percentage**
Asynchronous	26	28%
Synchronous	22	24%
Blended	44	48%
Total	92	100%

Appendix 23: Frequency of asynchronous media and technology

Asynchronous media and technology	**Number of applications**	**Percentage**
Audio recordings	2	8%
Blogs	3	12%
Bulletin boards / fora / threaded discussion	9	35%
Digital study materials	2	8%
Emails	2	8%
Multimedia platforms	2	8%
Online study materials	1	4%
Video recordings	2	8%
Web-based exercises / games	2	8%
Writing feedback platforms	1	4%
Total	26	100%

Appendix 24: Frequency of synchronous media and technology

Synchronous media and technology	**Number of applications**	**Percentage**
Chatrooms / chat tools	3	14%
Fora	1	5%
Instant messaging	3	14%
Multimedia platforms	4	18%
Presentation tools	1	5%
Real-time audio applications	2	9%
Social media sites	1	5%
Video chatting	1	5%
Video-conferencing	4	18%
Web-based exercises / games	1	5%
Writing feedback platforms	1	5%
Total	22	100%

Appendix 25: Frequency of blended media and technology

Blended media and technology	Number of applications	Percentage
Audio chatting (synchronous)	1	2%
Audio recordings (asynchronous)	2	5%
Blogs (asynchronous)	1	2%
Bulletin boards / fora (asynchronous)	3	7%
Chatrooms (synchronous)	2	5%
Emails (asynchronous)	3	7%
Instant messaging (synchronous)	4	9%
Multimedia materials (asynchronous)	3	7%
Picture sharing applications (asynchronous)	1	2%
Social networking sites (blended)	2	5%
Text chatting (asynchronous)	1	2%
Text chatting (synchronous)	3	7%
Video-conferencing (synchronous)	8	18%
Video recordings (asynchronous)	4	9%
Web-based exercises / games (asynchronous)	5	11%
Wikis (asynchronous)	1	2%
Total	44	100%

Appendix 26: Number of media and technology concurrently applied in L2 courses of included studies

Number of concurrent applications	Asynchronous mode		Synchronous mode		Blended mode	
	Number of courses	Number of applications	Number of courses	Number of applications	Number of courses	Number of applications
One	12	12	14	14	-	-
Two	3	6	1	2	9	18
Three	1	3	1	3	6	18
Four	-	-	-	-	1	4
Five	-	-	-	-	-	-
Six	-	-	-	-	2	12
Seven	-	-	-	-	-	-
Eight	-	-	-	-	-	-
Total	16	21	16	19	18	52

Appendix 27: Number of courses with various levels of structure in the three DE modes

	Number of L2 courses		
Levels of structure	Asynchronous	Synchronous	Blended
Very low (TD: 1)	-	-	1
Low (TD: 1 to ≤1.5)	2	1	7
Low to medium (TD: >1.5 to <2)	-	-	-
Medium (TD: 2)	7	8	7
Medium to high (TD: >2 to <2.5)	-	-	-
High (TD: ≥2.5 to <3)	7	7	3
Very high (TD: 3)	-	-	-
	16	16	18

Appendix 28: Number of courses with various levels of dialogue in the three DE modes

Levels of dialogue	Number of L2 courses		
	Asynchronous	Synchronous	Blended
Very low (TD: 1)	2	1	9
Low (TD: 1 to ≤1.5)	9	9	7
Low to medium (TD: >1.5 to <2)	-	-	0
Medium (TD: 2)	5	6	1
Medium to high (TD: >2 to <2.5)	-	-	0
High (TD: ≥2.5 to <3)	-	-	1
Very high (TD: 3)	-	-	0
	16	16	18

Appendix 29: Number of courses with various levels of autonomy in the three DE modes

	Number of L2 courses		
Levels of autonomy	Asynchronous	Synchronous	Blended
Very low (TD: 1)	1	1	4
Low (TD: 1 to ≤1.5)	9	5	9
Low to medium (TD: >1.5 to <2)	-	-	-
Medium (TD: 2)	6	10	5
Medium to high (TD: >2 to <2.5)	-	-	-
High (TD: ≥2.5 to <3)	-	-	-
Very high (TD: 3)	-	-	-
	16	16	18

Appendix 30: Mean values of TD and variable in courses of three DE modes

DE mode	Means of TD and variable scores			
	Structure High (3) - Low (1)	Dialogue High (1) - Low (3)	Autonomy High (1) - Low (3)	Overall TD High (3) - Low (1)
Asynchronous	2.16	1.59	1.66	1.80
Synchronous	2.19	1.66	1.78	1.87
Blended	1.83	1.33	1.53	1.54

Appendix 31: Transactional distance (TD) of included studies

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Abrams (2003)*	Asynchronous	WebCT bulletin board	2	1.5	2	1.83
	Synchronous	WebCT chat tool	2	1.5	2	1.83
Abuseileek & Qatawneh (2013) ***	Asynchronous	CMC with delayed audio chat module of the NetOP software	2.5	1	2	1.83
	Synchronous	CMC with real-time audio chat module	2.5	1.5	2	2.00
Arnold (2007)	Asynchronous	Platform for voluntary participation in forums (Blackboard)	2	2	1.5	1.83
	Synchronous	Platform for discussions in communicative curriculum (Blackboard)	2	2	2	2.00
Bailey, Almusharra and Hatcher (2020)	Asynchronous	LMS discussion forums (collaborative writing practice)	1.5	1.5	2	1.67
	Synchronous	Videoconferencing platform: Zoom (video-synchronous speaking practice)	2	1.5	2	1.83
Brandl (2012)	Asynchronous (required task)	Forum module in Moodle	2	1.5	1.5	1.67
	Asynchronous (optional task)		1.5	1.5	1	1.33
	Synchronous (required task)	Chat module in Moodle	2	1.5	1.5	1.67
	Synchronous (optional task)		1.5	1.5	1	1.33

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Brick (2012)	Blended	Social networking site for language learning (Busuu.com), consisting of synchronous and asynchronous video and text chat	1.5	1.5	1	1.33
Chang (2018)	Blended	Combination of synchronous video / voice / text chat-style distant interaction, and asynchronous Bulletin Board System (BBS)	1	1	1.5	1.16
Chang (2009)	Asynchronous	Web-based course management system and online commenting tool (E3)	2	1	1.5	1.50
	Synchronous	Instant messaging (IM) program (MSN)	2	1	1.5	1.50
Fujioka-Ito (2013)	Blended	Combination of synchronous virtual class in Blackboard (course management system), and asynchronous assignments using audio and video recordings that included grammar, vocabulary, and listening comprehension	1.5	1	1	1.16

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Gonzalez Moreno (2011)	Blended	Virtual platform consisting of collaborative projects, academic and cultural meetings, resource center of learning materials and media, and discussion board	2	1	2	1.67
Hauck (2007)	Asynchronous	Audio recording, blogs	2	1.5	1.5	1.67
	Synchronous	Audio graphic conferencing for live online discussion (Lyceum)	2	1.5	1.5	1.67
Hirotani (2009)	Asynchronous	CMC discussions (bulletin board tool: Mini-BBS3)	2.5	2	2	2.16
	Synchronous	CMC discussions (chat tool: MSN)	2.5	2	2	2.16
Huang (2020) †	Asynchronous	Discussion forum (Blackboard); video recording (Kaltura); multimedia assignment (Classkick); Chinese character writing exercises (Skritter)	2.5	1.5	1.5	1.83
	Synchronous	Videoconferencing (Zoom); interactive whiteboard (Google Jamboard); interactive presentation (Pear Deck); social media application (Slack)	2.5	1.5	1.5	1.83

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Jauregi and Banados (2008)	Blended	Combining asynchronous blogging and a synchronous video-web communication tool (Adobe Connect)	1.5	1	1.5	1.33
Jayaron and Mohammed (2016)	Asynchronous	Blogs	2	2	1.5	1.83
	Synchronous	Online forum discussion	2	2	2	2
Karaaslan, Kilic, Guven-Yalcin and Gullu (2018)	Blended	Combination of out-of-class asynchronous and in-class synchronous web-based multimedia games (using platforms of Kahoot, Quizlet, Nearpod, Powtoon, and YouTube)	2	1.5	1.5	1.33
Khodaparasta and Ghafournia (2015)	Asynchronous	Online materials, CDs of the related course book, audio recordings, software dictionaries and video clips	2.5	1.5	1.5	1.83
	Synchronous	Real-time online course, with text chatting with instant messaging, and video chatting (Skype)	2.5	1.5	2	2
	Blended	Combination of asynchronous and synchronous media and technology	2.5	1	1.5	1.33

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Kocdar, Karadeniz and Goksel (2018)	Blended	Combination of social networking site (Facebook), conducting synchronous and asynchronous structured activities and unstructured activities	1.5	1.5	1	1.33
Kusumawati (2020)	Blended	Combination of synchronous virtual meetings (Zoom), asynchronous text-based discussion, exchange of assignments and feedback, sharing pictures (Google Classroom) and video (YouTube), email, and instant messaging (WhatsApp)	1.5	1	1.5	1.33
Lin and Fang (2010)	Blended	CMC-enhanced communication, including email (asynchronous), instant and real-time chatroom (Internet Relay Chat (IRC))	2.5	2.5	1.5	2.16
Marcum and Kim (2020)	Blended	Synchronous online videoconferencing , and asynchronous video and texting in a learning management system (Canvas)	2	1.5	1.5	1.67

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Marull and Swapna (2020)	Blended	Asynchronous multimedia learning platform containing exercises for various L2 language skills (Pearson learning platform, MySpanishLab); synchronous telecollaborative virtual exchanges (LinguaMeeting and Zoom); asynchronous multimedia platform with authentic materials including videos, articles, audio clips (VoiceThread)	2	1	1.5	1.5
Mellati, Khademi, and Abolhassani (2018)	Blended	Combination of mobile synchronous messaging application (WhatsApp) and an asynchronous vocabulary mobile application (GRE vocabulary application)	1.5	1	1	1.17

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Moneypenny and Aldrich (2018)	Blended	Synchronous meetings (Skype, Google Hangouts, or Zoom) and asynchronous e-texts, videos, songs and quizzes based on recorded conversation sessions (2)	2	2	2	2
Nguyen (2011)	Blended	CMC including synchronous chat (Yahoo! Messenger), asynchronous blogging, email and wikis (4)	1.5	1.5	2	1.67
Pérez (2003)	Asynchronous	Email dialog journals (1)	2	2	2	2
	Synchronous	Chatroom sessions (1)	2	2	2	2
Perveen (2016)	Asynchronous	Emails, moderated discussion board (MDB) (2)	2.5	2	1.5	2
	Synchronous	Real-time interactive sessions (1)	2.5	2	1.5	2
	Blended	Combination of asynchronous and synchronous media and technology (3)	2.5	1	1.5	1.83

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Riwayatiningsih and Sulistyani (2020)**	Blended	Combination of asynchronous learning management system (Edmodo), writing application and website (Wattpad); synchronous videoconferencing (Zoom), instant messaging application (WhatsApp) (3)	2	1.5	2	1.83
Sato, Chen and Jourdain (2017)	Blended	Combination of Google Apps for Education and asynchronous online editing (Google Docs), multimodal commenting platform (VoiceThread); synchronous: multimedia communication platform with voice, audio and video (Google Hangouts) (3)	2	1.5	2	1.83
Shang (2017)	Asynchronous	Learning management system (Moodle) for assignment submission and written feedback (1)	2.5	1.5	2	2

Study	DE category	Media and technology	Structure score High (3) - Low (1)	Dialogue score High (1) - Low (3)	Autonomy score High (1) - Low (3)	TD score (average)
Sotillo (2000)*	Synchronous	Synchronous interface (Cool Sentence Corrective Network, www.pigai.org), providing immediate feedback and suggestions on vocabulary, collocation, and common grammar mistakes (1)	2.5	1.5	2	2
	Asynchronous	Asynchronous threaded discussion forum (1)	2.5	1.5	1.5	1.83
	Synchronous	Synchronous CMC discussion using a chatting software (Internet Relay Chat (mIRC)) (1)	2.5	2	2	2.17

Appendix 32: TD and variable values of courses conducted in the asynchronous mode

Study	TD and variable values of asynchronous courses			
	Structure High (3) - Low (1)	Dialogue High (1) - Low (3)	Autonomy High (1) - Low (3)	Overall TD High (3) - Low (1)
Abrams (2003)*	2	1.5	2	1.83
Abuseileek & Qatawneh (2013) ***	2.5	1	2	1.83
Arnold (2007)	2	2	1.5	1.83
Bailey, Almusharra and Hatcher (2020)	1.5	1.5	2	1.67
Brandl (2012) (Required task)	2	1.5	1.5	1.67
Brandl (2012) (Optional task)	1.5	1.5	1	1.33
Chang (2009)	2	1	1.5	1.50
Hauck (2007)	2	1.5	1.5	1.67
Hirotani (2009)	2.5	2	2	2.16
Huang (2020) †	2.5	1.5	1.5	1.83
Jayaron and Mohammed (2016)	2	2	1.5	1.83
Khodaparasta and Ghafournia (2015)	2.5	1.5	1.5	1.83
Pérez (2003)	2	2	2	2
Perveen (2016)	2.5	2	1.5	2
Shang (2017)	2.5	1.5	2	2
Sotillo (2000)*	2.5	1.5	1.5	1.83
Mean	2.16	1.59	1.66	1.80

Appendix 33: Levels of TD variables of courses conducted in the asynchronous mode

	Number of L2 courses			
Levels of TD	Structure	Dialogue	Autonomy	Overall TD
Very low (TD: 1)	-	2	1	-
Low (TD: 1 to ≤1.5)	2	9	9	2
Low to medium (TD: >1.5 to <2)	-	-	-	10
Medium (TD: 2)	7	5	6	3
Medium to high (TD: >2 to <2.5)	-	-	-	1
High (TD: ≥2.5 to <3)	7	-	-	-
Very high (TD: 3)	-	-	-	-

Appendix 34: TD and variable values of courses conducted in the synchronous mode

Study	TD and variable values of synchronous courses			
	Structure High (3) - Low (1)	Dialogue High (1) - Low (3)	Autonomy High (1) - Low (3)	Overall TD High (3) - Low (1)
Abrams (2003)*	2	1.5	2	1.83
Abuseileek & Qatawneh (2013) ***	2.5	1.5	2	2.00
Arnold (2007)	2	2	2	2.00
Bailey, Almusharra and Hatcher (2020)	2	1.5	2	1.83
Brandl (2012) (Required task)	2	1.5	1.5	1.67
Brandl (2012) (Optional task)	1.5	1.5	1	1.33
Chang (2009)	2	1	1.5	1.50
Hauck (2007)	2	1.5	1.5	1.67
Hirotani (2009)	2.5	2	2	2.16
Huang (2020) †	2.5	1.5	1.5	1.83
Jayaron and Mohammed (2016)	2	2	2	2
Khodaparasta and Ghafournia (2015)	2.5	1.5	2	2
Pérez (2003)	2	2	2	2
Perveen (2016)	2.5	2	1.5	2
Shang (2017)	2.5	1.5	2	2
Sotillo (2000)*	2.5	2	2	2.17
Mean	2.19	1.66	1.78	1.87

Appendix 35: Levels of TD variables of courses conducted in the synchronous mode

	Number of courses			
Levels of TD	Structure	Dialogue	Autonomy	Overall TD
Very low (TD: 1)	-	1	1	-
Low (TD: 1 to ≤1.5)	1	9	5	2
Low to medium (TD: >1.5 to <2)	-	-	-	5
Medium (TD: 2)	8	6	10	7
Medium to high (TD: >2 to <2.5)	-	-	-	2
High (TD: ≥2.5 to <3)	7	-	-	-
Very high (TD: 3)	-	-	-	-

Appendix 36: TD and variable values of courses conducted in the blended mode

Study	TD and variable values of blended courses			
	Structure High (3) - Low (1)	Dialogue High (1) - Low (3)	Autonomy High (1) - Low (3)	Overall TD High (3) - Low (1)
Brick (2012)	1.5	1.5	1	1.33
Chang (2018)	1	1	1.5	1.16
Fujioka-Ito (2013)	1.5	1	1	1.16
Gonzalez Moreno (2011)	2	1	2	1.67
Jauregi and Banados (2008)	1.5	1	1.5	1.33
Karaaslan, Kilic, Guven-Yalcin and Gullu (2018)	2	1.5	1.5	1.33
Khodaparasta and Ghafournia (2015)	2.5	1	1.5	1.33
Kocdar, Karadeniz and Goksel (2018)	1.5	1.5	1	1.33
Kusumawati (2020)	1.5	1	1.5	1.33
Lin and Fang (2010)	2.5	2.5	1.5	2.16
Marcum and Kim (2020)	2	1.5	1.5	1.67
Marull and Swapna (2020)	2	1	1.5	1.5
Mellati, Khademi, and	1.5	1	1	1.17

Study	TD and variable values of blended courses			
	Structure High (3) - Low (1)	Dialogue High (1) - Low (3)	Autonomy High (1) - Low (3)	Overall TD High (3) - Low (1)
Abolhassani (2018)				
Moneypenny and Aldrich (2018)	2	2	2	2
Nguyen (2011)	1.5	1.5	2	1.67
Perveen (2016)	2.5	1	1.5	1.83
Riwayatiningsih and Sulistyani (2020)**	2	1.5	2	1.83
Sato, Chen and Jourdain (2017)	2	1.5	2	1.83
Mean	1.83	1.33	1.53	1.54

Appendix 37: Levels of TD variables of courses conducted in the blended mode

	Number of courses			
Levels of TD	Structure	Dialogue	Autonomy	Overall TD
Very low (TD: 1)	1	9	4	-
Low (TD: 1 to ≤1.5)	7	7	9	10
Low to medium (TD: >1.5 to <2)	-	-	-	6
Medium (TD: 2)	7	1	5	1
Medium to high (TD: >2 to <2.5)	-	-	-	1
High (TD: ≥2.5 to <3)	3	1	-	-
Very high (TD: 3)	-	-	-	-

Appendix 38: Levels of TD and results of courses conducted in the asynchronous mode

	Findings		
Levels of TD	**Positive**	**Mixed**	**Negative**
Very low (TD: 1)	0	0	0
Low (TD: 1 to ≤1.5)	2	2	0
Low to medium (TD: >1.5 to <2)	10	2	0
Medium (TD: 2)	2	3	0
Medium to high (TD: >2 to <2.5)	1	0	0
High (TD: ≥2.5 to <3)	0	0	0
Very high (TD: 3)	0	0	0
Total	15	7	0

Appendix 39: Levels of TD and results of courses conducted in the synchronous mode

	Findings		
Level of TD	**Positive**	**Mixed**	**Negative**
Very low (TD: 1)	0	0	0
Low (TD: 1 to ≤1.5)	3	1	0
Low to medium (TD: >1.5 to <2)	4	2	0
Medium (TD: 2)	3	5	0
Medium to high (TD: >2 to <2.5)	1	3	0
High (TD: ≥2.5 to <3)	0	0	0
Very high (TD: 3)	0	0	0
Total	11	11	0

Appendix 40: Levels of TD and results of courses conducted in the blended mode

	Findings		
Level of TD	**Positive**	**Mixed**	**Negative**
Very low (TD: 1)	0	0	0
Low (TD: 1 to ≤1.5)	12	1	0
Low to medium (TD: >1.5 to <2)	7	2	0
Medium (TD: 2)	0	1	0
Medium to high (TD: >2 to <2.5)	0	0	1
High (TD: ≥2.5 to <3)	0	0	0
Very high (TD: 3)	0	0	0
Total	19	4	1

Appendix 41: Number of courses conducted in DE modes accordingly to levels of TD

	Asynchronous		Synchronous		Blended	
Level of TD	**Studies**	**%**	**Studies**	**%**	**Studies**	**%**
Very low (TD: 1)	-	-	-	-	-	-
Low (TD: 1 to ≤1.5)	2	12.5%	2	12.5%	10	55.5%
Low to medium: (TD: >1.5 to <2)	10	62.5%	5	31.2%	6	33.3%
Medium: (TD: 2)	3	18.7%	8	50%	1	5.6%
Medium to high (TD: >2 to <2.5)	1	6.3%	1	6.3%	1	5.6%
High (TD: ≥2.5 to <3)	-	-	-	-	-	-
Very high: (TD: 3)	-	-	-	-	-	-
	16	100%	16	100%	18	100%

Appendix 42: DE categories (modes) and levels of TD of included studies

Included studies	DE category		
	Asynchronous	Synchronous	Blended
Abrams* (2003)	1.83	1.83	-
Abuseileek & Qatawneh (2013) ***	1.83	2.00	-
Arnold (2007)	1.83	2.00	-
Bailey, Almusharra and Hatcher (2020)	1.67	1.83	-
Brandl (2012)	1.67 (Required task)	1.67 (Required task)	-
	1.33 (Optional task)	1.33 (Optional task)	-
Brick (2012)	-	-	1.33
Chang (2018)	-	-	1.16
Chang (2009)	1.50	1.50	-
Fujioka-Ito (2013)	-	-	1.16
Gonzalez Moreno (2011)	-	-	1.67
Hauck (2007)	1.67	1.67	-
Hirotani (2009)	2.16	2.16	-
Huang (2020) †	1.83	1.83	-
Jauregi and Banados (2008)	-	-	1.33
Jayaron and Mohammed (2016)	1.83	2.00	-
Karaaslan, Kilic, Guven-Yalcin and Gullu (2018)	-	-	1.33

Included studies	DE category		
	Asynchronous	Synchronous	Blended
Khodaparasta and Ghafournia (2015)	1.83	2.00	1.33
Kocdar, Karadeniz and Goksel (2018)	-	-	1.33
Kusumawati (2020)	-	-	1.33
Lin and Fang (2010)	-	-	2.16
Marcum and Kim (2020)	-	-	1.67
Marull and Swapna (2020)	-	-	1.50
Mellati, Khademi, and Abolhassani (2018)	-	-	1.17
Moneypenny and Aldrich (2018)	-	-	2.00
Nguyen (2011)	-	-	1.67
Pérez (2003)	2.00	2.00	
Perveen (2016)	2.00	2.00	1.83
Riwayatiningsih and Sulistyani (2020)**	-	-	1.83
Sato, Chen and Jourdain (2017)	-	-	1.83
Shang (2017)	2.00	2.00	-
Sotillo (2000)*	1.83	2.17	-
Mean	**1.84**	**1.93**	**1.54**

Appendix 43: Summary of findings

Included studies	DE categories	TD levels	Measures	Findings
Abrams* (2003)	Asynchronous (WebCT bulletin board)	Low to medium	L2 learning (Quantity of language produced by learners)	Positive
		Low to medium	L2 learning (Quality of language produced by learners`)	Positive
	Synchronous (WebCT chat tool)	Low to medium	L2 learning (Quantity of language produced by learners)	Positive
		Low to medium	L2 learning (Quality of language produced by learners`)	Positive
Abuseileek & Qatawneh (2013) ***	Asynchronous (CMC with delayed audio chat module)	Low to medium	L2 learning (Discourse features of learners' language output)	Higher
	Synchronous (CMC with real-time audio chat module)	Medium	L2 learning (Discourse features of learners' language output)	Lower
Arnold (2007)	Asynchronous (Voluntary participation in forums (Blackboard))	Low to medium	Emotion (Learners' degree of communication apprehension)	Mixed
	Synchronous (Discussions in communicative curriculum (Blackboard))	Medium	Emotion (Learners' degree of communication apprehension)	Mixed
Bailey, Almusharra and Hatcher (2020)	Asynchronous (LMS discussion forums (collaborative writing practice))	Low to medium	Motivation (Learners' course satisfaction and intrinsic motivation)	Positive
	Synchronous (Videoconference platform Zoom (video-synchronous speaking practice))	Low to medium	Motivation (Learners' course satisfaction and intrinsic motivation)	Lower
Brandl (2012)	Asynchronous (Forum module in Moodle)	Low to medium (Required task)	L2 learning (Quantity and quality of use of language by learners)	Mixed
		Low (Optional task)	L2 learning (Quantity and quality of use of language by learners)	Mixed
	Synchronous (Chat module in Moodle)	Low to medium (Required task)	L2 learning (Quantity and quality of use of language)	Positive
		Low (Optional task)	L2 learning (Quantity and quality of use of language)	Higher

Included studies	DE categories	TD levels	Measures	Findings
Brick (2012)	Blended (Social networking site with synchronous and asynchronous video and text chat)	Low	Perception and attitude (Learners' overall impression of the DE platform)	Positive
Chang (2018)	Blended (Synchronous video / voice / text chat-style distant interaction, and asynchronous Bulletin Board System (BBS))	Low	L2 learning (Learners' TOEIC score)	Higher
			Perception and attitude (Learners' attitudes towards cross-cultural distance learning (CCDL))	Positive
Chang (2009)	Asynchronous (Web-based course management system and online commenting tool (E3))	Low	Perception and attitude (Learners' perception DE peer review and writing improvement)	Positive
			Perception and attitude (Learners' perception of convenience and efficacy)	Positive
			Perception and attitude (Learners' perception of interaction)	Mixed
	Synchronous (Instant messaging (IM) program MSN))	Low	Perception and attitude (learners' perception DE peer review and writing improvement)	Positive
			Perception and attitude (Learners' perception of convenience and efficacy)	Positive
			Perception and attitude (Learners' perception of interaction)	Mixed
Fujioka-Ito (2013)	Blended (Synchronous virtual class in Blackboard and asynchronous assignments using audio and video recordings)	Low	Perception and attitude (learners' attitudes towards DE classes)	Positive
Gonzalez Moreno (2011)	Blended (Virtual platform consisting of collaborative projects, academic and cultural meetings, resource centre of learning materials and media, and discussion boards)	Low to medium	Perception and attitude (Teachers and tutors' attitudes towards virtual learning programme)	Mixed
			Perception and attitude (Learners' attitudes towards virtual learning programme)	Mixed
Hauck (2007)	Asynchronous (Audio recording, blogs)	Low to medium	Perception and attitude (Learners' feedback of the DE programme	Mixed

Included studies	DE categories	TD levels	Measures	Findings
	Synchronous (Audio graphic conferencing for live online discussion (Lyceum))	Low to medium	Perception and attitude (Learners' feedback of the DE programme	Mixed
Hirotani (2009)	Asynchronous (CMC discussions (bulletin board tool: Mini-BBS3)	Medium to high	L2 learning (Learners' oral proficiency: number of words, language units, and clause (AS unit: Analysis of Speech Unit); syntactic complexity, and accuracy)	Positive
	Synchronous (CMC discussions via chat tool: MSN)	Medium to high	L2 learning (Learners' oral proficiency: number of words, language units, and clause (AS unit: Analysis of Speech Unit); syntactic complexity, and accuracy)	Positive
Huang (2020) †	Asynchronous (Discussion forum (Blackboard); video recording (Kaltura); multimedia assignment (Classkick); Chinese character writing exercises (Skritter))	Low to medium	Perception and attitude (Learners' attitudes towards the DE course, tools, and language gains)	Positive
	Synchronous (Videoconferencing (Zoom); interactive whiteboard (Google Jamboard); interactive presentation (Pear Deck); social media application (Slack)	Low to medium	Perception and attitude (Learners' attitudes towards the DE course, tools, and language gains)	Positive
Jauregi and Banados (2008)	Blended (Asynchronous blogging and a synchronous video-web communication tool (Adobe Connect))	Low	Perception and attitude (Learners' and trainee teachers' evaluation of the DE course (interaction, cultural exchange, motivation)	Positive
Jayaron and Mohammed (2016)	Asynchronous (Blogs)	Low to medium	L2 learning (Lexical complexity of learners' output: lexical diversity, lexical density syntactic complexity, lexical diversity and density)	Positive
			Perception and attitude (Learners' perception: feeling, motivation, interaction, writing skills, autonomy and challenges)	Positive

Included studies	DE categories	TD levels	Measures	Findings
	Synchronous (Online forum discussion)	Medium	L2 learning (Lexical complexity of learners' output: lexical diversity, lexical density syntactic complexity, lexical diversity and density)	Positive
			Perception and attitude (Learners' perception: feeling, motivation, interaction, writing skills, autonomy and challenges)	Mixed
Karaaslan, Kilic, Guven-Yalcin and Gullu (2018)	Blended (Out-of-class asynchronous and in-class synchronous web-based multimedia games (using platforms of Kahoot, Quizlet, Nearpod, Powtoon, and YouTube)	Low	Perception and attitude (Learners' reflection on web-based multimedia vocabulary games: interest, meaningfulness, team spirit, learning new skills, practicality in terms of time-effectiveness)	Positive
Khodaparasta and Ghafournia (2015)	Asynchronous (Online materials, CDs of the related course book, audio recordings, software dictionaries and video clips)	Low to medium	L2 learning (Learners' vocabulary achievement)	Positive
	Synchronous (Real-time online course, with text chatting, instant managing, and video chatting (Skype))	Medium	L2 learning (Learners' vocabulary achievement)	Positive
	Blended (Combination of the asynchronous and synchronous modes)	Low	L2 learning (Learners' vocabulary achievement)	Highest
Kocdar, Karadeniz and Goksel (2018)	Blended (Social networking site (Facebook), conducting synchronous and asynchronous structured activities and unstructured activities)	Low	Perception and attitude (Learners' attitudes towards to the self-paced EFL course: connectedness with the group and a sense of community; learning effectiveness)	Positive
Kusumawati (2020)	Blended (Synchronous virtual meetings (Zoom), asynchronous text-based discussion, exchange of assignments and feedback, sharing pictures (Google Classroom) and video (YouTube), email, and instant messaging (WhatsApp))	Low	Perception and attitude (Learners' attitude towards blended learning: materials and instruction, learning desire, self-confidence, improvement of speaking skills)	Positive
			L2 learning (pronunciation practice of learners)	Positive

Included studies	DE categories	TD levels	Measures	Findings
Lin and Fang (2010)	Blended (CMC-enhanced communication, including email (asynchronous), instant and real-time chatroom (Internet Relay Chat (IRC))	Medium to high	Perception and attitude (Learners' perception of the DE programme)	Negative
Marcum and Kim (2020)	Blended (Synchronous online videoconferencing, and asynchronous video and texting in a learning management system (Canvas))	Low to medium	L2 learning (Learners' improvement of oral proficiency)	Positive
			Perception and attitude (Learners' perception of the course (overall effectiveness; contribution of dialogue with teachers/tutors to learning)	Positive
Marull and Swapna (2020)	Blended (Asynchronous multimedia learning platform containing exercises for various L2 language skills (Pearson learning platform, MySpanishLab); synchronous telecollaborative virtual exchanges (LinguaMeeting and Zoom); asynchronous multimedia platform with authentic materials including videos, articles, audio clips (VoiceThread))	Low	Perception and attitude (Learners' perception of learning effectiveness (oral fluency, listening comprehension, pronunciation, vocabulary knowledge, cultural knowledge, anxiety about speaking with a native speaker, and the ability to apply linguistic skills to authentic situations)	Positive
Mellati, Khademi, and Abolhassani (2018)	Blended (Mobile synchronous messaging application (WhatsApp) and an asynchronous vocabulary mobile application (GRE vocabulary application)	Low	L2 learning (Learners' GRE vocabulary test score)	Positive
			Perception and attitude (Learners' perceived usefulness of the OMLL course (independency and confidence; feedback; variety of learning applications accommodating individual differences; monitoring of progress; opportunity to practice language outside the classroom; motivation; learner-centeredness)	Mixed

Included studies	DE categories	TD levels	Measures	Findings
Moneypenny and Aldrich (2018)	Blended (Synchronous meetings (Skype, Google Hangouts, or Zoom) and asynchronous quiz based on recorded conversation sessions)	Medium	L2 learning (Learners' learning progress according to the American Council on the Teaching of Foreign Languages (ACTFL) benchmark (measuring oral proficiency based on pronunciation, fluency, vocabulary, and sentence formation as components of an overall proficiency score))	Mixed
Nguyen (2011)	Blended (CMC including synchronous chat (Yahoo! Messenger), asynchronous blogging, email and wikis)	Low to medium	Perception and attitude (Learners' perceptions of both synchronous and asynchronous CMC in the development of EFL learners' collaborative learning (interest, ease of usage, learning effectiveness))	Positive
Pérez (2003)	Asynchronous (Email dialog journals)	Medium	L2 learning (Number of new vocabulary words produced by learners in the email journals as opposed to that of chatroom sessions)	Not significant
			Perception and attitude (Learners' preference of DE mode)	Mixed
	Synchronous (Chatroom sessions)	Medium	L2 learning (Number of new vocabulary words produced by learners in the email journals as opposed to that of chatroom sessions)	Not significant
			Perception and attitude (Learners' preference of DE mode)	Positive
Perveen (2016)	Asynchronous (emails, moderated discussion board (MDB))	Medium	Perception and attitude (Learners' preference of DE mode)	Mixed
	Synchronous (Real-time interactive sessions)	Medium	Perception and attitude (Learners' preference of DE mode)	Mixed
	Blended (Combination of the asynchronous and synchronous modes)	Low to medium	Perception and attitude (Learners' preference of DE mode)	Preferred

Included studies	DE categories	TD levels	Measures	Findings
Riwayatiningsih and Sulistyani (2020)**	Blended (Asynchronous learning management system (Edmodo), writing application and website (Wattpad); synchronous videoconferencing (Zoom), instant messaging application (WhatsApp))	Low to medium	Perception and attitude (Learners' feedback on blended learning)	Preferred
Sato, Chen and Jourdain (2017)	Blended (Google Apps for Education and asynchronous online editing (Google Docs), multimodal commenting platform (VoiceThread); synchronous: multimedia communication platform with voice, audio and video (Google Hangouts))	Low to medium	L2 learning (Integrated performance assessment of learners (language function, use of text types, communication strategies, comprehensibly and language control)	Positive
			Perception and attitude (Learners' perceived attitudes and experiences: effectiveness of learning language skills, and 5Cs: Communication, Connection, Comparison, Culture, Community)	Positive
Shang (2017)	Asynchronous (Learning management system (Moodle) for assignment submission and written feedback)	Medium	L2 learning (Syntactic complexity of students' writing)	Higher
			Perception and attitude (Learners' attitudes towards the effectiveness of the APF and SCF modes)	Preferred
	Synchronous (Synchronous interface (Cool Sentence Corrective Network, www.pigai.org): immediate feedback and suggestions on vocabulary, collocation, and common grammar mistakes)	Medium	L2 learning (Syntactic complexity of students' writing)	Lower
			Perception and attitude (Learners' attitudes towards the effectiveness of the APF and SCF modes)	Positive but not preferred
Sotillo (2000)*	Asynchronous (Threaded discussion forum)	Low to medium	L2 learning (Syntactic complexity of learners' writing: use of subordination and embedded subordinate clauses)	Higher
	Synchronous (CMC discussion: chatting software (Internet Relay Chat (mIRC))	Medium to high	L2 learning (Syntactic complexity of learners' writing: use of subordination and embedded subordinate clauses)	Lower

Appendix 44: Systematic mapping of included studies

Systematic mapping of included studies

Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Abrams*	2003	The effects of synchronous and asynchronous CMC on oral performance in German	• L1 English → L2 German • L2 area: speaking • L2 level: intermediate	USA (university)	96 university students	WebCT chat tool (1)	WebCT bulletin board (1)	N/A	• IV: type of instruction (synchronous, asynchrony or CI) • DV: Quantity of language produced • DV: Quality of language produced (lexical richness, lexical density, syntactic complexity)	• Quantitative • Quasi-experimental • 1 semester • Intact classes	• Amount of Language Output: C-units • Lexical Richness (type-token ratio) • Lexical Density • Pretest-intervention-posttest of scores • One-way ANOVA	H
Abuseileek & Qatawneh ***	2013	Effects of synchronous and asynchronous computer-mediated communication (CMC) oral conversations on English language learners' discourse functions	• Multiple L1s (unspecified) → L2 English • L2 area: speaking • Level: elementary to intermediate	Jordan (university)	30 high school and university students (aged 19-21)	Asynchronous CMC: delayed Audio Chat module of the NetOP software (1)	Synchronous CMC: real-time Audio Chat module (1)	N/A	• IV: type of instruction (synchronous or asynchronous) • DV: discourse feature (question types and strategies)	• Quantitative • Quasi-experimental • 6 weeks • Intact classes	• Discourse features of (question types and strategies) • Four raters (applied linguistics) transcribed and analysed the discourse features of students' conversations	M
Arnold	2007	Reducing foreign language communication apprehension with computer-mediated communication: A preliminary study	• L1 English → L2 German • L2 area: speaking • L2 level: intermediate	USA (university)	56 university students	Platform for voluntary participation in forums (Blackboard) (1)	Platform for discussions in communicative curriculum (Blackboard) (1)	N/A	• IV: type of instruction (synchronous, asynchrony or CI) • DV: communication apprehension	• Mixed • Quasi-experimental • 1 semester	• Pretest and posttest questionnaires: modified version of the Language Classroom Anxiety Scale (FLCAS) • Two Likert-scale items on nervousness and self-confidence • Repeated-measures ANOVA	H

*Paper from backward citation search **Paper from forward citation search ***Paper from both backward and forward citation search †Non-English paper (Chinese) NI: The information was 'not indicated' in the paper.
Method and measures: IV: independent variable; DV: dependent variable

Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Bailey, Almusharra and Hatcher	2020	Finding satisfaction: intrinsic motivation for synchronous and asynchronous communication in the online language learning context	• L1 Korean ➔ L2 German • L2 area: general • L2 level: intermediate	South Korea (university)	186 (Male=88, Female=98) freshman (n = 127) and sophomore (n = 59) students	LMS discussion forums (collaborative writing practice) (1)	Videoconference platform Zoom (video-synchronous speaking practice) (1)	N/A	• IV: type of instruction (synchronous or asynchrony) • DV: course satisfaction and intrinsic motivation	• Mixed • Experimental • 10 weeks	• Likert-type rating scale (Intrinsic Motivation Inventory) and open-ended survey • Descriptive statistics; Pearson correlation • Linear regression Confirmatory factor analysis (CFA) and cluster analysis (qualitative data)	H
Brandl	2012	Effects of required and optional exchange tasks in online language learning environments	• L1 English ➔ L2 German • L2 area: general • L2 level: novice	USA (university)	86 university students (aged 18-25)	Forum module in Moodle (1)	Chat module in Moodle (1)	N/A	• IV: type of instruction (synchronous or asynchrony) • IV: type of task (required or optional) • DV: quantity and quality of use of language	• Quantitative • Quasi-experimental • 9 sections • Intact groups	• Instruments of optional and jigsaw (required) task activities (filling family tree chart to test general use of language) • Two-Way ANOVA	H
Brick	2012	The Role of Social Networking Sites for Language Learning in UK Higher Education: The Views of Learners and Practitioners	• L1s English, French, Spanish, Greek ➔ German • L2 area: general • L2 levels: various	UK (higher education and university)	15 higher education language teachers and 14 undergraduate learners (9 male and 3 female) (UK; higher education)	N/A	N/A	Busuu.com (social networking site for language learning), consisting of synchronous and asynchronous video and text chat (2)	Overall impression of the DE platform	• Mixed • Cross-sectional • Non-experimental • 3 months	• Online questionnaire on impression of DE platofmr (Likert scale) • Logsheet (activites and reflection of students) • Group interview	M

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Method and measures: IV: independent variable; DV: dependent variable

Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Chang	2018	The effects of cross-cultural distance learning model on the linguistic and affective domain of EFL learners in Korea	• L1s Korean, Japanese → L2 English • L2 area: general • L2 level: intermediate	South Korea, Japan (university)	53 Korean (mostly freshman) and 69 Japanese students	N/A	N/A	Blended learning consisting of synchronous video / voice / text chat-style distant interaction with LiveOn session, and asynchronous Bulletin Board Sy stem (BBS) session named CourseN@vi. (4)	• Learners' TOEIC score • Learners' attitudes towards cross-cultural distance learning (CCDL)	• Mixed • Cross-sectional • 1 semester • Non-experimental	• TOEIC-Type Test (measuring English language proficiency); pretest-intervention-posttest of scores • Questionnaire (cultural awareness and attitude for cross-cultural distance learning) • Semi-structured individual interview	M
Chang	2009	Peer review through synchronous and asynchronous CMC modes: A case study in a Taiwanese college English writing course	• L1 Chinese → L2 English • L2 area: writing • L2 level: intermediate	Taiwan (university)	30 under-graduates	E3 (web-based course management system and online commenting tool) (1)	MSN (instant messaging (IM) program) (1)	N/A	Learners' perception of peer review in DE writing course: • Writing improvement • Convenience and efficacy • Interaction	• Mixed • Cross-sectional • Non-experimental • 18 weeks	• On-line transcripts • Two questionnaires	M
Fujioka-Ito	2013	Designing a Curriculum for a Distance Learning Class: An Example of a First-year Japanese Course	• L1 NI → L2 Japanese • L2 area: general • L2 level: intermediate	USA (university)	18 students, 18 teachers	N/A	N/A	Combination of synchronous virtual class in Blackboard (course management system), and asynchronous assignments using audio and video recordings that included grammar, vocabulary, and listening comprehension (3)	Learners' attitudes toward distance learning classes	• Qualitative • Cross-sectional • Non-experimental • 18 weeks • Blended lessons included scaffolding, peer collaboration	Course survey	M

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Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Gonzalez Moreno	2011	The Role of Discussion Boards in a University Blended Learning Program	• L1 Spanish → L2 English • L2: general • L2 level: NI	Colombia (university)	20 under-graduates; 4 teachers and 3 tutors	N/A	N/A	A virtual platform consisting of collaborative projects, academic and cultural meetings, resource centre of learning materials and media, and discussion boards (2)	• Learners' attitudes toward virtual learning programme • Teachers and tutors' attitudes toward virtual learning programme	• Qualitative • Cross-sectional • Non-experimental • 1 term	Observation, survey and reflections	M
Hauck	2007	Critical success factors in a TRIDEM exchange	• L1s English, French → L2s English, French • L2s' area: general • L2 level: various	USA, UK, France (universities)	5 (UK Open University), 10 (Carnegie Mellon,), 10 (French native speakers at Université de Franche Comté)	Audio recording, blogs (2)	Audio graphic conferencing for live online discussion (1)	N/A	Learners' feedback of the DE programme	• Mixed • Cross-sectional • Non-experimental • 10 weeks • Telecollaboration with linguistic interaction and intercultural learning of UK, USA and French students	• Pre- and post-treatment questionnaires • Post-treatment semi-structured interviews • Screen data capture (using the CAMTASIA software) • Audio recordings (synchronous environment) • Learner production (synchronous and asynchronous environment/blogs)	M

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Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Hirotani***	2009	Synchronous versus asynchronous CMC and transfer to Japanese oral performance	• L1s English, Chinese, Korean → L2 Japanese • L2 area: speaking • L2 level: novice • Participants: 18 (synchronous group), 19 (asynchronous group), 18 (CI) students	USA (university)	18 (synchronous group), 19 (asynchronous group), 18 (CI) students	Asynchronous CMC discussions (bulletin board tool: Mini-BBS3) (1)	Synchronous CMC discussions (chat tool: MSN) (1)	N/A	• IV: type of instruction (synchronous or asynchronous) • DV: oral proficiency: number of words, language units, and clause (AS unit: Analysis of Speech Unit); syntactic complexity, and accuracy	• Qualitative • Quasi-experimental • Intact groups • 1 semester	• Oral pretest and the post-test • Questionnaire • One-Way ANOVA • Pearson correlation coefficients	M
Huang†	2020	Technology-enhanced online language education: A standards-based online elementary Chinese course (Chinese title: 科技赋能网络教育：标准为本的初级汉语网络课程设计及科技应用)	• L1s multiple (NI) → L2 Chinese • L2 area: general • L2 level: elementary	USA (university)	13 students	Discussion forum (Blackboard); video recording (Kaltura); multimedia assignment (Classkick); Chinese character writing exercises (Skritter) (3)	Video-conferencing (Zoom); interactive whiteboard (Google Jamboard); interactive presentation (Pear Deck); social media application (Slack) (3)	N/A	Attitudes towards the DE course, tools, and language gains	• Quantitative • Cross-sectional • Non-experimental • 2 terms	• Survey • Likert Scale	M

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Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Jauregi and Banados	2008	Virtual interaction through video-web communication: A step towards enriching and internationalizing language learning programs	• L1 Dutch → L2 Spanish • L2 area: general • L2 level: advanced	The Netherlands, Chile (universities)	20 students (The Netherlands) and 20 trainee teachers (Chile)	N/A	N/A	Blended: asynchronous blogging and a synchronous video-web communication tool (Adobe Connect) (2)	Learners' and trainee teachers' evaluation of the DE course (interaction, cultural exchange, motivation)	• Qualitative • Cross-sectional • Non-experimental • From 2005 to early 2006	• Questionnaire • Recordings of learners' interaction sessions • Information posted in the project blog	M
Jayaron and Mohammed	2016	A Pedagogical Perspective on Promoting English as a Foreign Language Writing through Online Forum Discussions.	• L1 Arabic → L2 English • L2 area: writing • L2 level: elementary	Oman (university)	56 college students	Blogs (1)	Online forum discussion (1)	N/A	• Lexical complexity of learners' output (lexical diversity, lexical density syntactic complexity, lexical diversity and lexical density) • Learners' perception (feeling, motivation, interaction, writing skills, autonomy) • Learners' comments on challenges	• Mixed • Cross-sectional • 1 semester (10 weeks) • Non-experimental	• Pre-test and post-test • Writing test (argumentative essay writing of 300 words) • Interview	M
Karaaslan, Kilic, Guven-Yalcin and Gullu	2018	Students' Reflections on Vocabulary Learning through Synchronous and Asynchronous Games and Activities	• L1 Turkish → L2 English • L2 area: vocabulary • L2 level: intermediate	Turkey (university English preparatory school)	45 university English preparatory school students (aged 18-20)	N/A	N/A	Combination of out-of-class asynchronous and in-class synchronous web-based multimedia games (using platforms of Kahoot, Quizlet, Nearpod, Powtoon, and YouTube) (2)	Learners' reflection on web-based multimedia vocabulary games (items included interest, meaningfulness, sense of team spirit, learning of new skills, practicality in terms of time-effectiveness)	• Qualitative • Cross-sectional • 8 weeks • Non-experimental	Questionnaire	M

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Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Khodaparasta and Ghafournia	2015	The effect of asynchronous/synchronous approaches on English vocabulary achievement: A study of Iranian EFL learners	• L1 Farsi ➔ L2 English • L2 area: vocabulary • L2 level: intermediate	Iran (university)	120 sophomores (aged 20 to 26)	Online materials, CDs of the related course book, audio recordings, software dictionaries and video clips (3)	Real-time online course, with text chatting, instant managing, and video chatting (Skype) (3)	Combination of asynchronous and synchronous media and technologies (3)	• IV: type of instruction (synchronous, asynchronous, blended or CI as control group) • DV: EFL learners' vocabulary achievement in an~ intensive reading course	• Quantitative • Quasi-experimental • 1 EFL course (period: NI)	• Pre-test and post-test • Barons' IBT Practice Test (reading comprehension and vocabulary)	M
Kocdar, Karadeniz and Goksel	2018	Using Facebook for leveraging sense of community in self-paced open and distance learning courses	• L1 Turkish ➔ L2 English • L2 area: general • L2 level: NI	Turkey (distance-teaching university)	176 university students	N/A	N/A	Social networking site (Facebook), conducting synchronous and asynchronous structured activities and unstructured activities (2)	Learners' attitudes towards to the self-paced EFL course (connectedness with the group and a sense of community; learning effectiveness)	• Mixed • Cross-sectional • 1 academic year • Non-experimental	• Questionnaire • Interview	M

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Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Kusumawati	2020	Redesigning Face-to-face into Online Learning for Speaking Competence during COVID-19: ESP for Higher Education in Indonesia	• L1 Indonesian ➔ L2 English • L2 area: speaking; English for Electrical Engineering (EEE) • L2 level: NI	Indonesia (university)	118 (CI) and 96 (DE) students	N/A	N/A	Combination of synchronous virtual meetings (Zoom), asynchronous text-based discussion, exchange of assignments and feedback, sharing pictures (Google Classroom) and video (YouTube), email, and instant messaging (WhatsApp) (6)	• IV: type of instruction (blended or CI); • DV: Attitude towards blended learning (materials and instruction, learning desire, self-confidence, improvement of speaking skills, interaction with the teacher) • DV: Learning effectiveness (pronunciation practice)	• Mixed • Quasi-experimental • 1 academic year (period: NI)	• Presentation assessment • Questionnaire using five-point Likert scale and open-ended questions • Compared the learning outcome and attitude of a presentation project using CI and DE	M
Lin and Fang	2010	EFL learners' perceptions of computer-mediated communication (CMC) to facilitate communication in a foreign language	• L1 Chinese ➔ L2 English • L2 area: speaking • L2 level: intermediate (minimum TOEFL score of 530)	Taiwan (university)	96 sophomores (aged 19 to 23); most with an additional L2 (Japanese)	N/A	N/A	CMC-enhanced communication, including email (asynchronous), instant and real-time chatroom (Internet Relay Chat (IRC)) (2)	Students' perception of the DE programme	• Qualitative • Cross-sectional • 1 semester (4 months) • The EFL programme was conducted by 1 instructor, supported by peer feedback amongst learners	Online, and offline communication protocols, open-ended interviews and reflection papers composed by participants	M

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Method and measures: IV: independent variable; DV: dependent variable

Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Marcum and Kim	2020	Oral Language Proficiency in Distance English-Language Learning	• Multiple L1s ➔ L2 English • L2 area: speaking • L2 level: elementary to intermediate	USA (pre-university)	Participants: 56 students (from 15 countries)	N/A	N/A	Synchronous online videoconferencing, and asynchronous video and texting in a learning management system (Canvas) (3)	• Learners' improvement of oral proficiency • Learners' perception of the course (overall effectiveness; contribution of dialogue with teachers/tutors to learning)	• Mixed • Cross-sectional • Non-experimental • 13 weeks (143 hours)	• Pre-test and post-test • Computer-assisted Oral Proficiency Interview (OPIc) • Course survey • Repeated measures ANOVA	H
Marull and Swapna	2020	Authentic Language Learning through Telecollaboration in Online Courses	• L1 English ➔ L2 Spanish • L2 area: speaking • L2 level: elementary	USA (university)	297 under-graduates	N/A	N/A	Asynchronous multimedia learning platform containing exercises for various L2 language skills (Pearson learning platform, MySpanishLab); synchronous telecollaborative virtual exchanges (LinguaMeeting and Zoom); asynchronous multimedia platform with authentic materials including videos, articles, audio clips (VoiceThread) (3)	Learners' perception of learning effectiveness (oral fluency, listening comprehension, pronunciation, vocabulary knowledge, cultural knowledge, anxiety about speaking with a native speaker, and the ability to apply linguistic skills to authentic situations)	• Mixed • Cross-sectional • Non-experimental • 2017 to spring 2019	• Post-course survey • Two Likert scale questions	H

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						Asynchronous	Synchronous	Blended				
Mellati, Khademi, and Abolhassani	2018	Creative interaction in social networks: Multi-synchronous language learning environments	• L1 Farsi ➔ L2 English • L2 area: vocabulary • L2 level: intermediate (CEFR B1)	Iran (language institute)	90 female (aged 18 to 35)	N/A	N/A	Combining mobile synchronous messaging application (WhatsApp) and an asynchronous vocabulary mobile application (GRE vocabulary application) (2)	• IV: type of instruction (blended or CI) • DV: Vocabulary test score • DV: Learners' perceived usefulness of the OMLL course (independency and confidence; feedback; variety of learning applications accommodating individual differences; monitoring of progress; opportunity to practice language outside the classroom; motivation; learner-centeredness) • DV: Learners' perception of challenges	• Mixed • Quasi-experimental • 1 month • An online mobile language learning (OMLL) course	• GRE vocabulary test (pretest and posttest) • Semi-structured interview • ANCOVA	H
Moneypenny and Aldrich	2018	Developing oral proficiency in Spanish across class modalities	• L1 English ➔ L2 Spanish • L2 area: speaking • L2 level: novice to intermediate	USA (university)	108 undergraduates (aged 18 to 45)	N/A	N/A	Combining synchronous meetings (Skype, Google Hangouts, or Zoom) and asynchronous quiz based on recorded conversation sessions (2)	Learning progress according to the American Council on the Teaching of Foreign Languages (ACTFL) benchmark (measuring oral proficiency based on pronunciation, fluency, vocabulary, and sentence formation as components of an overall proficiency score)	• Quantitative • Longitudinal • Non-experimental • 2 academic years (4 semesters)	• Pearson Versant Test for Spanish (oral proficiency) • (pretest and posttest) • Compared to the ACTFL benchmark	H

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Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Nguyen	2011	Learners' Reflections on and Perceptions of Computer-Mediated Communication in a Language Classroom: A Vietnamese Perspective	• L1 Vietnamese ➔ L2 English • L2 area: general • L2 level: various	Vietnam (university)	30 university students in a teaching English as a foreign language (TDFL) programme (aged 21 to 24)	N/A	N/A	CMC including synchronous chat (Yahoo! Messenger), asynchronous blogging, email and wikis (4)	Students perceptions of both synchronous and asynchronous CMC in the development of EFL learners' collaborative learning (interest, ease of usage, learning effectiveness)	• Mixed • Cross-sectional • Non-experimental • 12 weeks	• 4-point Likert scale questionnaire • Semi-structured interview	H
Pérez	2003	Foreign Language Productivity in Synchronous Versus Asynchronous Computer-mediated Communication	• L1 English ➔ L2 Spanish • L2 area: writing • L2 level: elementary	USA (university)	24 university students (aged 19 to 23)	Email dialog journals (1)	Chatroom session (1)	N/A	Number of new vocabulary words produced in the email journals as opposed to that of chatroom sessions Preference of DE mode	Mixed Cross-sectional 1 semester Within-subject design IV: comparing asynchronous and synchronous CMC	Tallying the number of vocabulary words produced in the email journals as opposed to new vocabulary words produced in chatroom session Questionnaire	H
Perveen	2016	Synchronous and asynchronous e-language learning: A case study of virtual university of Pakistan	• L1 Urdu ➔ L2 English • L2 area: general and technical business English • L2 level: NI	Pakistan (virtual university)	1025 under-graduates and postgraduates (aged 17 to 30)	Emails, moderated discussion board (MDB) (2)	Real-time interactive sessions (1)	Combination of both asynchronous and synchronous modes (3)	• IV: comparing asynchronous and synchronous CMC • DV: Preference of DE mode	• Mixed • Experimental • Within-subject design • 5 months	Structured questionnaire Discussion	M

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Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Riwayatiningsih and Sulistyani**	2020	The Implementation of Synchronous and Asynchronous E-Language Learning in EFL Setting: A Case Study	• L1 Indonesian ➔ L2 English • L2 area: writing • L2 level: NI	Indonesia (university)	55 university students	N/A	N/A	Combining asynchronous: learning management system (Edmodo), writing application and website (Wattpad); and synchronous videoconferencing (Zoom), instant messaging application (WhatsApp) (3)	Learners' feedback on blended learning	• Mixed • Cross-sectional • 1 semester • Non-experimental study • Writing course involving three stages of different asynchronous and synchronous activities	Survey questionnaire Interview	M

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Method and measures: IV: independent variable; DV: dependent variable

Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Sato, Chen and Jourdain,	2017	Integrating Digital Technology in an Intensive, Fully Online College Course for Japanese Beginning Learners: A Standards-Based, Performance-Driven Approach	• L1s Chinese, English, Korea, Indonesian → L2 Japanese • L2 area: general • L2 level: elementary	USA (university)	26 university students	N/A	N/A	Combination of asynchronous (Online editing (Google Docs), multimodal commenting platform (VoiceThread) and synchronous instructions (Multimedia communication platform with voice, audio and video (Google Hangouts) (3)	• IV: type of instruction (blended or CI) • DV: integrated performance assessment of learners (language function, use of text types, communication strategies, comprehensibly and language control) • DV: learners' perceived attitudes and experiences (effectiveness of learning language skills, and 5 Cs: Communication, Connection, Comparison, Culture, Community)	• Mixed • Quasi-experimental • 1 semester (6 weeks intensive course)	• Integrated Performance-Based Assessments (IPA) Scoring Rubric of communicative competence in the target language • Weekly learning journals • Pre-course and post-course survey (perceived attitudes and experiences)	M

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Method and measures: IV: independent variable; DV: dependent variable

Author	Year	Title	SLL/FLL	Setting	Sample	Media and technology (number of types)			Variable	Methodology	Measurement and analysis	WOE
						Asynchronous	Synchronous	Blended				
Shang	2017	An exploration of asynchronous and synchronous feedback modes in EFL writing	• L1 Chinese → L2 English • L2 area: writing • L2 levels: various	Taiwan (university)	44 freshmen (aged 18-21) Context:	Learning management system (Moodle) for assignment submission and written feedback (asynchronous peer feedback (APF)) (1)	Synchronous interface (Cool Sentence Corrective Network, www.pigai.org), providing immediate feedback and suggestions on vocabulary, collocation, and common grammar mistakes (synchronous corrective feedback (SCF)) (1)	N/A	• IV: type of writing feedback (asynchronous peer feedback (APF) or synchronous corrective feedback (SCF)) • DV: syntactic complexity of students' writing • DV: learners' attitudes about the effectiveness of the APF and SCF modes	• Mixed • Experimental • 18 weeks (freshman English writing course) • Within-subject design	• Questionnaire (five-point Likert scale) • Semi-structured interview • Computerised text analysis program of syntactic complexity (WordSmith Tools 6.0)	M
Sotillo*	2000	Discourse functions and syntactic complexity in synchronous and asynchronous communication	• L1s Arabic, Japanese, Korean, Polish, Russian, and Spanish → L2 English • L2 area: writing • L2 levels: advanced	USA; university	25 university students (aged 18-31)	Asynchronous threaded discussion forum (1)	Synchronous CMC discussion using a chatting software (Internet Relay Chat (mIRC)) (1)	N/A	Syntactic complexity of students' writing (use of subordination and embedded subordinate clauses)	• Quantitative • Cross-sectional • 4 months (ESL writing course) • Within-subject design	• Analysis of discourse functions in students' writing • T-test	H

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Appendix 45: Summary of findings (included studies)

Summary of findings (included studies)

Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Abrams* (2003)	• L1 English → L2 German • L2 area: speaking • L2 level: intermediate • Participants: 96 university students • Setting: USA; university	• Asynchronous: WebCT bulletin board (1) • Synchronous: WebCT chat tool (1)	• Quantitative • Quasi-experimental • 1 semester • Intact classes • IV: type of instruction (synchronous, asynchrony or CI)	DV: Quantity of language produced by learners DV: Quality of language produced (lexical richness, lexical density, syntactic complexity) by learners	Higher Mixed	1.83 1.83	Higher Mixed	1.83 1.83	N/A	N/A
Abuseileek & Qatawneh (2013) ***	• Multiple L1s (unspecified) → L2 English • L2 area: speaking • L2 level: elementary to intermediate • Participants: 30 high school and university students (aged 19-21) • Setting: Jordan; university	• Asynchronous: CMC with delayed audio chat module of the NetOP software (1) • Synchronous: CMC with real-time audio chat module (1)	• Quantitative • Quasi-experimental • 6 weeks • Intact classes • IV: type of instruction (synchronous or asynchronous)	DV: discourse features (question types and strategies) of learners' language output	Higher (more opportunities to think and reflect; less intimidated than in the synchronous mode; generated more questions)	1.83	Lower	2.00	N/A	N/A

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Method and measures: IV: independent variable; DV: dependent variable **TD:** ST: structure; DI: dialogue; AU: autonomy; TD: overall transactional distance **TD level:** H: high; M: medium; L: Low

Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Arnold (2007)	• L1 English ➔ L2 German • L2 area: speaking • L2 level: intermediate • Participants: 56 university students • Setting: USA; university	• Asynchronous: a platform for voluntary participation in forums (Blackboard) (1) • Synchronous: a platform for discussions in communicative curriculum (Blackboard) (1)	• Mixed • Quasi-experimental • 1 semester • IV: type of instruction (synchronous, asynchrony or CI)	DV: learners' degree of communication apprehension	Mixed	1.83	Mixed	2.00	N/A	N/A
Bailey, Almusharra and Hatcher (2020)	• L1 Korean ➔ L2 German • L2 area: general • L2 level: intermediate • Participants: 186 (Male=88, Female=98) freshman (n = 127) and sophomore (n = 59) students • Setting: South Korea; university	• Asynchronous: LMS discussion forums (collaborative writing practice) (1) • Synchronous: videoconference platform Zoom (video-synchronous speaking practice) (1)	• Mixed • Experimental • 10 weeks • IV: type of instruction (synchronous or asynchronous)	DV: learners' course satisfaction and intrinsic motivation	Higher (cognitive load is lower)	1.67	Lower	1.83	N/A	N/A

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Brandl (2012)	• L1 English ➔ L2 German • L2 area: general • L2 level: novice • Participants: 86 university students (aged 18-25) • Setting: USA; university	• Asynchronous: forum module in Moodle (1) • Synchronous: chat module in Moodle (1)	• Quantitative • Quasi-experimental • 9 sections • Intact groups • IV: type of instruction (synchronous or asynchronous) • IV: type of task (required or optional)	DV: quantity and quality of use of language by learners (required tasks) DV: quantity and quality of use of language by learners (optional tasks)	Mixed Mixed	1.67 1.33	Positive Higher	1.67 1.33	N/A	N/A
Brick (2012)	• L1s English, French, Spanish, Greek ➔ German • L2 area: general • L2 levels: various • Participants: 15 higher education language teachers and 14 undergraduate learners • Setting: UK; higher education	• Blended: a social networking site for language learning (Busuu.com), consisting of synchronous and asynchronous video and text chat (2)	• Mixed • Cross-sectional • Non-experimental • 3 months	Learners' overall impression of the DE platform	N/A	N/A	N/A	N/A	Positive	1.33

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Chang (2018)	• L1s Korean, Japanese ➔ L2 English • L2 area: general • L2 level: intermediate • Participants: 53 Korean (mostly freshman) and 69 Japanese students • Setting: South Korea, Japan; university	• Blended: combination of synchronous video / voice / text chat-style distant interaction, and asynchronous Bulletin Board System (BBS) (4)	• Mixed • Cross-sectional • 1 semester • Non-experimental	Learners' TOEIC score Learners' attitudes towards cross-cultural distance learning (CCDL)	N/A	N/A	N/A	N/A	Higher Positive	1.16 1.16
Chang (2009)	• L1 Chinese ➔ L2 English • L2 area: writing • L2 level: intermediate • Participants: 30 undergraduate • Setting: Taiwan; university	• Asynchronous: a web-based course management system and online commenting tool (E3) (1) • Synchronous: an instant messaging (IM) program MSN) (1)	• Mixed • Cross-sectional • Non-experimental • 18 weeks	Learners' perception of peer review in DE writing course: • Writing improvement • Convenience and efficacy • Interaction	 Positive Positive Less tension; fewer negotiation	 1.50 1.50 1.50	 Positive Positive More difficult to keep up; scheduling problem; confusion	 1.50 1.50 1.50	N/A	N/A

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Fujioka-Ito (2013)	• L1 NI → L2 Japanese • L2 area: general • L2 level: intermediate • Participants: 18 students, 18 teachers • Setting: USA; university	Blended: combination of synchronous virtual class in Blackboard (course management system), and asynchronous assignments using audio and video recordings that included grammar, vocabulary, and listening comprehension (3)	• Qualitative • Cross-sectional • Non-experimental • 18 weeks • Blended lessons included scaffolding, peer collaboration	Learners' attitudes towards DE classes	N/A	N/A	N/A	N/A	Positive (flexibility, access to learning materials, interaction)	1.16
Gonzalez Moreno (2011)	• L1 Spanish → L2 English • L2: general • L2 level: NI • Participants: 20 undergraduates; 4 teachers and 3 tutors • Setting: Colombia; university	Blended: A virtual platform consisting of collaborative projects, academic and cultural meetings, resource centre of learning materials and media, and discussion boards (2)	• Qualitative • Cross-sectional • Non-experimental • 1 term	Teachers and tutors' attitudes towards virtual learning programme	N/A	N/A	N/A	N/A	Mixed (higher workload; outcome depended on learning styles)	1.67
				Learners' attitudes towards virtual learning programme					Mixed	1.67

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Hauck (2007)	• L1s English, French → L2s English, French • L2s' area: general • L2 level: various • Participants: 5 adult learners (UK), 10 undergraduates (USA), 10 French postgraduates (France) • Setting: UK, USA France; universities	• Asynchronous: audio recording and blogs (2) • Synchronous: audio graphic conferencing for live online discussion (Lyceum) (1)	• Mixed • Cross-sectional • Non-experimental • 10 weeks • Telecollaboration with linguistic interaction and intercultural learning of UK, USA and French students	Learners' feedback of the DE programme	Mixed (positive overall and motivated; imbalanced participa-tion; cultural differences of UK, USA, and French students)	1.67	Mixed (positive overall and motivated; some anxiety time difference and scheduling issues; cultural differences)	1.67	N/A	N/A
Hirotani (2009)	• L1s English, Chinese, Korean → L2 Japanese • L2 area: speaking • L2 level: novice • Participants: 18 (synchronous group), 19 (asynchronous group), 18 (CI) students • Setting: USA; university	• Asynchronous: asynchronous CMC discussions (bulletin board tool: Mini-BBS3) (1) • Synchronous: synchronous CMC discussions (chat tool: MSN) (1)	• Qualitative • Quasi-experimental • Intact groups • 1 semester • IV: type of instruction (synchronous or asynchronous)	Learners' oral proficiency: number of words, language units, and clause (AS unit: Analysis of Speech Unit); syntactic complexity, and accuracy	Higher syntactic complexity	2.16	Higher number of AS-units (separate language units)	2.16	N/A	N/A

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Huang (2020) †	• L1s multiple (NI) ➔ L2 Chinese • L2 area: general • L2 level: elementary • Participants: 13 students • Setting: USA; university	• Asynchronous: discussion forum (Blackboard); video recording (Kaltura); multimedia assignment (Classkick); Chinese character writing exercises (Skritter) (3) • Synchronous: videoconferencing (Zoom); interactive whiteboard (Google Jamboard); interactive presentation (Pear Deck); social media application (Slack) (3)	• Quantitative • Cross-sectional • Non-experimental • 2 terms	Learners' attitudes towards the DE course, tools, and language gains	Positive (language gain, positive attitudes, convenience; ease of participation)	1.83	Positive (language gain, positive attitudes, convenience; ease of participation)	1.83	N/A	N/A
Jauregi and Banados (2008)	• L1 Dutch ➔ L2 Spanish • L2 area: general • L2 level: advanced • Participants: 20 students (The Netherlands) and 20 trainee teachers (Chile) • Setting: The Netherlands, Chile; universities	• Blended: asynchronous blogging and a synchronous video-web communication tool (Adobe Connect) (2)	• Qualitative • Cross-sectional • Non-experimental • From 2005 to early 2006	Learners' and trainee teachers' evaluation of the DE course (interaction, cultural exchange, motivation)	N/A	N/A	N/A	N/A	Positive (cultural differences; Chileans were more motivated; some technical issues for Chilean trainee teachers)	1.33

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Jayaron and Mohammed (2016)	• L1 Arabic → L2 English • L2 area: writing • L2 level: elementary • Participants: 56 college students • Setting: Oman; college	• Asynchronous: blogs (1) • Synchronous: online forum discussion (1)	• Mixed • Cross-sectional • 1 semester (10 weeks) • Non-experimental	Lexical complexity of learners' output (lexical diversity, lexical density syntactic complexity, lexical diversity and lexical density)	Positive	1.83	Positive (higher syntactic complexity)	2.00	N/A	N/A
				Learners' perception (feeling, motivation, interaction, writing skills, autonomy)	Positive	1.83	Positive	2.00		
				Learners' comments on challenges			Technical issues, timing			
Karaaslan, Kilic, Guven-Yalcin and Gullu (2018)	• L1 Turkish → L2 English • L2 area: vocabulary • L2 level: intermediate • Participants: 45 university English preparatory school students (aged 18-20) • Setting: Turkey; university English preparatory school	• Blended: combination of out-of-class asynchronous and in-class synchronous web-based multimedia games (using platforms of Kahoot, Quizlet, Nearpod, Powtoon, and YouTube) (2)	• Qualitative • Cross-sectional • 8 weeks • Non-experimental	Learners' reflection on web-based multimedia vocabulary games (items included interest, meaningfulness, sense of team spirit, learning of new skills, practicality in terms of time-effectiveness)	N/A	N/A	N/A	N/A	Positive overall (despite some considered games impractical)	1.33

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Khodaparasta and Ghafournia (2015)	• L1 Farsi → L2 English • L2 area: vocabulary • L2 level: intermediate • Participants: 120 sophomores (aged 20 to 26) • Setting: Iran; university	• Asynchronous: online materials, CDs of the related course book, audio recordings, software dictionaries and video clips (3) • Synchronous: real-time online course, with text chatting, instant messaging, and video chatting (Skype) (3) • Blended: combination of asynchronous and synchronous media and technology (6)	• Quantitative • Quasi-experimental • 1 EFL course (period: NI) • IV: type of instruction (synchronous, asynchronous, blended or CI as control group)	EFL learners' vocabulary achievement in an intensive reading course	Positive	1.83	Positive	2.00	Positive (significantly higher achievement than other three groups)	1.33
Kocdar, Karadeniz and Goksel (2018)	• L1 Turkish → L2 English • L2 area: general • L2 level: NI • Participants: 179 students • Setting: Turkey; distance-teaching university	• Blended: social networking site (Facebook), conducting synchronous and asynchronous structured activities and unstructured activities (2)	• Mixed • Cross-sectional • 1 academic year • Non-experimental	Learners' attitudes towards to the self-paced EFL course (connectedness with the group and a sense of community; learning effectiveness)	N/A	N/A	N/A	N/A	Positive	1.33

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Kusumawati (2020)	• L1 Indonesian → L2 English • L2 area: speaking; English for Electrical Engineering (EEE) • L2 level: NI • Participants: 118 (CI) and 96 (DE) students • Setting: Indonesia; university	• Blended: synchronous virtual meetings (Zoom), asynchronous text-based discussion, exchange of assignments and feedback, sharing pictures (Google Classroom) and video (YouTube), email, and instant messaging (WhatsApp) (6)	• Mixed • Quasi-experimental • 1 academic year (period: NI) • IV: type of instruction (blended or CI) • Compared the learning outcome and attitude of a presentation project using CI and DE	DV: Learners' attitude towards blended learning: • Materials and instruction, learning desire, self-confidence, improvement of speaking skills • Interaction with the teacher DV: Learning effectiveness (pronunciation practice of learners)	N/A	N/A	N/A	N/A	Positive Highly positive Positive (higher than CI)	1.33 1.33 1.33
Lin and Fang (2010)	• L1 Chinese → L2 English • L2 area: speaking • L2 level: intermediate (minimum TOEFL score of 530) • Participants: 96 sophomores (aged 19 to 23); most with an additional L2 (Japanese) • Setting: Taiwan; university	• Blended: CMC-enhanced communication, including email (asynchronous), instant and real-time chatroom (Internet Relay Chat (IRC)) (2)	• Qualitative • Cross-sectional • 1 semester (4 months) • The EFL programme was conducted by 1 instructor, supported by peer feedback amongst learners	Learners' perception of the DE programme	N/A	N/A	N/A	N/A	Negative (regarded as artificial and not authentic; delayed peer feedback due to workload; limited feedback from a single instructor)	2.16

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Marcum and Kim (2020)	• Multiple L1s ➔ L2 English • L2 area: speaking • L2 level: elementary to intermediate • Participants: 56 students (from 15 countries) • Setting: USA; pre-university	• Blended: synchronous online videoconferencing, and asynchronous video and texting in a learning management system (Canvas) (3)	• Mixed • Cross-sectional • Non-experimental • 13 weeks (143 hours)	Learners' improvement of oral proficiency	N/A	N/A	N/A	N/A	Positive (significant improve-ment; 71% of students progressed 1-2 proficiency sub-levels)	1.67
				Learners' perception of the course (overall effectiveness; contribution of dialogue with teachers/tutors to learning)					Positive	1.67
Marull and Swapna (2020)	• L1 English ➔ L2 Spanish • L2 area: speaking • L2 level: elementary • Participants: 297 undergraduates • Setting: USA; university	• Blended: asynchronous multimedia learning platform containing exercises for various L2 language skills (Pearson learning platform, MySpanishLab); synchronous telecollaborative virtual exchanges (LinguaMeeting and Zoom); asynchronous multimedia platform with authentic materials including videos, articles, audio clips (VoiceThread) (3)	• Mixed • Cross-sectional • Non-experimental • 2017 to spring 2019	Learners' perception of learning effectiveness (oral fluency, listening comprehension, pronunciation, vocabulary knowledge, cultural knowledge, anxiety about speaking with a native speaker, and the ability to apply linguistic skills to authentic situations)	N/A	N/A	N/A	N/A	Positive overall (some comments on scheduling issues in synchronous sessions)	1.50

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Method and measures: IV: independent variable; DV: dependent variable **TD:** ST: structure; DI: dialogue; AU: autonomy; TD: overall transactional distance **TD level:** H: high; M: medium; L: Low

Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Mellati, Khademi, and Abolhassani (2018)	• L1 Farsi → L2 English • L2 area: vocabulary • L2 level: intermediate (CEFR B1) • Participants: 90 female (aged 18 to 35) • Setting: Iran; language centre	• Blended: mobile synchronous messaging application (WhatsApp) and an asynchronous vocabulary mobile application (GRE vocabulary application) (2)	• Mixed • Quasi-experimental • 1 month • An online mobile language learning (OMLL) course • IV: type of instruction (blended or CI)	Learners' GRE vocabulary test score	N/A	N/A	N/A	N/A	Positive (outperform CI and statistically significant improvement in post-test)	1.17
				Learners' perceived usefulness of the OMLL course (independency and confidence; feedback; variety of learning applications accommodating individual differences; monitoring of progress; opportunity to practice language outside the classroom; motivation; learner-centeredness)					Positive (less anxiety than CI)	1.17
				Learners' perception of challenges					Privacy; technology literacy	1.17

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Moneypenny and Aldrich (2018)	• L1 English → L2 Spanish • L2 area: speaking • L2 level: novice to intermediate • Participants: 108 undergraduates (aged 18 to 45) • Setting: USA; university	• Blended: synchronous meetings (Skype, Google Hangouts, or Zoom) and asynchronous quiz based on recorded conversation sessions (2)	• Quantitative • Longitudinal • Non-experimental • 2 academic years (4 semesters)	Learners' learning progress according to the American Council on the Teaching of Foreign Languages (ACTFL) benchmark (measuring oral proficiency based on pronunciation, fluency, vocabulary, and sentence formation as components of an overall proficiency score)	N/A	N/A	N/A	N/A	Mixed (42% met or exceeded the first year overall oral proficiency benchmark of Intermediate-Low and 27.5% met or exceeded the second year overall benchmark of Intermediate-Mid)	2.00

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Nguyen (2011)	• L1 Vietnamese → L2 English • L2 area: general • L2 level: various • Participants: 30 university students in a teaching English as a foreign language (TDFL) programme (aged 21 to 24) • Setting: Vietnam; university	• Blended: CMC including synchronous chat (Yahoo! Messenger), asynchronous blogging, email and wikis (4)	• Mixed • Cross-sectional • Non-experimental • 12 weeks	Learners' perceptions of both synchronous and asynchronous CMC in the development of EFL learners' collaborative learning (interest, ease of usage, learning effectiveness)	N/A	N/A	N/A	N/A	Positive overall (some concern of student participation; technology literacy and access)	1.67
Pérez (2003)	• L1 English → L2 Spanish • L2 area: writing • L2 level: elementary • Participants: 24 university students (aged 19 to 23) • Setting: USA; university	• Asynchronous: email dialog journals (1) • Synchronous: chatroom sessions (1)	• Mixed • Experimental • Within-subject design • 1 semester • IV: comparing asynchronous and synchronous CMC	DV: Number of new vocabulary words produced by learners in the email journals as opposed to that of chatroom sessions	No significant difference from the synchronous mode	2.00	No significant difference from the asynchronous mode	2.00	N/A	N/A
				DV: Learners' preference of DE mode	Equal to the synchronous mode (more time to think and less intimidating; more output; more personalised; more preparation required)	2.00	Positive overall; equal to the asynchronous mode (more learning opportunities from the instructor and the peers; negotiation of meaning)	2.00	N/A	N/A

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Perveen (2016)	• L1 Urdu → L2 English • L2 area: general and technical business English • L2 level: NI • Participants: 1025 undergraduates and postgraduates (aged 17 to 30) • Setting: Pakistan; virtual university	• Asynchronous: emails, moderated discussion board (MDB) (2) • Synchronous: real-time interactive sessions (1) • Blended: combination of both asynchronous and synchronous media and technology (3)	• Mixed • Experimental • Within-subject design • 5 months • IV: comparing asynchronous and synchronous CMC	Learners' preference of DE mode	Mixed (not time bound; allow time to reflect; written responses; limited interaction and delayed feedback)	2.00	Mixed (more interaction and immediate feedback; majority of students did not participate actively	2.00	Preferred (with benefits of both synchronies and to compensate the drawbacks of each mode)	1.83
Riwayatiningsih and Sulistyani (2020)**	• L1 Indonesian → L2 English • L2 area: writing • L2 level: NI • Participants: 55 university students • Setting: Indonesia; university	• Blended: asynchronous learning management system (Edmodo), writing application and website (Wattpad); synchronous videoconferencing (Zoom), instant messaging application (WhatsApp) (3)	• Mixed • Cross-sectional • Non-experimental • 1 semester • Writing course involving three stages of different asynchronous and synchronous activities	Learners' feedback on blended learning	N/A	N/A	N/A	N/A	Preferred (with benefits of both synchronies; more interaction in the synchronous mode and deeper learning from the asynchronous mode)	1.83

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Sato, Chen and Jourdain (2017)	• L1s Chinese, English, Korea, Indonesian → L2 Japanese • L2 area: general • L2 level: elementary • Participants: 26 university students • Setting: USA; university	• Blended: Google Apps for Education and asynchronous online editing (Google Docs), multimodal commenting platform (VoiceThread); synchronous: multimedia communication platform with voice, audio and video (Google Hangouts) (3)	• Mixed • Quasi-experimental • 1 semester (6 weeks intensive course) • IV: type of instruction (blended or CI)	Integrated performance assessment of learners (language function, use of text types, communication strategies, comprehensibly and language control)	N/A	N/A	N/A	N/A	Positive (higher than the CI group; statistically significantly difference in terms of communicat-ion strategy)	1.83
				Learners' perceived attitudes and experiences (effectiveness of learning language skills, and 5Cs: Communication, Connection, Comparison, Culture, Community)					Positive overall	1.83

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Study	Background	DE mode: media and technology (no. of types)	Methodology	Variable and measurement	Asynchronous		Synchronous		Blended	
					Result	TD	Result	TD	Result	TD
Shang (2017)	• L1 Chinese ➔ L2 English • L2 area: writing • L2 levels: various • Participants: 44 freshmen (aged 18-21) • Setting: Taiwan; university	• Asynchronous: a learning management system (Moodle) for assignment submission and written feedback (1) • Synchronous: synchronous interface (Cool Sentence Corrective Network, www.pigai.org), providing immediate feedback and suggestions on vocabulary, collocation, and common grammar mistakes (1)	• Mixed • Experimental • 18 weeks (freshman English writing course) • Within-subject design • IV: type of writing feedback (asynchronous peer feedback (APF) or synchronous corrective feedback (SCF))	Syntactic complexity of students' writing	Higher	2.00	Lower	2.00	N/A	N/A
				Learners' attitudes towards the effectiveness of the APF and SCF modes	Positive (the preferred mode)	2.00	Positive	2.00		
Sotillo (2000)*	• L1s Arabic, Japanese, Korean, Polish, Russian, and Spanish ➔ L2 English • L2 area: writing • L2 levels: advanced • Participants: 25 university students (aged 18-31) • Setting: USA; university	• Asynchronous: asynchronous threaded discussion forum (1) • Synchronous: Synchronous CMC discussion using a chatting software (Internet Relay Chat (mIRC)) (1)	• Quantitative • Cross-sectional • 4 months (ESL writing course) • Within-subject design	Syntactic complexity of learners' writing (use of subordination and embedded subordinate clauses)	Higher	1.83	Lower	2.17	N/A	N/A

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Appendix 46: Summary of excluded studies (during in-depth review)

Summary of excluded studies (during in-depth review)

Author	Year	Title	Paper type	DE study (Y/N)	SLL/FLL study (Y/N)	At least 2 DE synchrony (Y/N)	Eligible sample?	Country / region	Education institution?	L1 → L2	Contextual details?	WOE
Aljumah	2020	The impact of the EFL undergraduate students' integration in distance learning with its various platforms									Insufficient	L
Chun	2011	Developing intercultural communicative competence through online exchanges									Insufficient	
Cinganotto	2016	Content and Language Integrated Learning with Technologies: A Global Online Training Experience									Insufficient	L
Cinkara and Bagceci	2013	Learner's Attitudes towards Online Language Learning: and Corresponding Success Rates									Insufficient	
Correia Martins, Moreira and Moreira	2013	Online Role-Plays: Combining Situational and Interactional Authenticity in Foreign Language Learning	Conference paper								Insufficient	L
Craig and Kim,	2011	Performance and anxiety in videoconferencing	Book article									
Cunningham, Fagersten, and Holmsten,	2010	"Can You Hear Me, Hanoi?" Compensatory Mechanisms Employed in Synchronous Net-Based English Language Learning				N						
Dağ Akbaş and Kayaoğlu	2017	Tertiary Level Students' Initial Experiences Of Learning Medical English									Insufficient	L
de Lama	2013	A Spanish university case study: User's perception of blended methodology used for English Foreign Language learning		N								
Dobberfuhl-Quinlan	2018	Exploring Sociocultural Theory Application in Online Language Courses	Conference paper									

Reasons of exclusion (not fulfilling criteria of eligibility) are highlighted in blue

Author	Year	Title	Paper type	DE study (Y/N)	SLL/FLL study (Y/N)	At least 2 DE synchrony (Y/N)	Eligible sample?	Country / region	Education institution?	L1 ➔ L2	Contextual details?	WOE
Fischer, Yang and Lai	2018	A proposed flipped classroom method: Using online collaboration to enhance students' out-of-class oral academic English learning									Insufficient	
Foucher	2010	Chat, Forum, and Macro Task for French as a Foreign Language Learning: Which Possible Connection[s] for Which Contribution[s]?									Insufficient	
Ha	2014	Second language teachers' perceptions of blended learning									Insufficient	L
Hampel	2009	Training teachers for the multimedia age: developing teacher expertise to enhance online learner interaction and collaboration									Insufficient	
Huang	2013	E-reading and e-discussion: EFL learners' perceptions of an e-book reading program									Insufficient	
Jones	2014	Interaction in Google Wave sends chat rooms out with the tide	Book chapter									
Kim	2015	A blended learning scenario to enhance learners' oral production skills.		N								
Kuddus and Khan	2021	Attitude of the International Students Towards Integrating ICT in Foreign Language Learning: A Case Study	Book chapter									
Kyppö and Natr	2016	Promoting Multilingual Communicative Competence through Multimodal Academic Learning Situations	Conference paper									
Lin and Yang	2015	Effects of Online Culturally Responsive Pedagogy: Collaborative Learning Between College Tutors and Indigenous					N (indigenous students in rural areas with limited resources					

Reasons of exclusion (not fulfilling criteria of eligibility) are highlighted in blue

Author	Year	Title	Paper type	DE study (Y/N)	SLL/FLL study (Y/N)	At least 2 DE synchrony (Y/N)	Eligible sample?	Country / region	Education institution?	L1 ➔ L2	Contextual details?	WOE
		High School Students					and economic disadvantage)					
Lotfi and Pozveh	2019	The Effect of Synchronous and Asynchronous Language Learning: A Study of Iranian EFL Intermediate Students' Vocabulary Learning					N (120 teenagers aged 12 to 18)					
Montero, Watts, and Garcıa-Carbonell	2007	Discussion forum interactions: Text and context									Insufficient	
Moreno-Lopez and Miranda-Aldaco	2013	Quantitative study comparing network-based language teaching (NBTL) to traditional Spanish classes									Insufficient	L
Orsini-Jones and Cerveró Carrascosa	2019	BMELTET -- Blending MOOCs into English Language Teacher Education with Telecollaboration	Conference paper								Insufficient	
Pineda	2017	Development of language accuracy using synchronous and asynchronous learning activities									Insufficient	L
Krish, Maros, and Stapa	2012	Sociocultural Factors And Social Presence In An Online Learning Environment									Insufficient	
Sadler	2007	Computer-mediated communication and a cautionary tale of two cities									Insufficient	
Saeed, Ghazali, Sahuri and Abdulrab	2018	Engaging EFL Learners in Online Peer Feedback on Writing: What Does It Tell Us?									Insufficient	
Sevingil and Bayyurt	2010	Making a shift towards new CMC modes									Insufficient	
Sew	2012	Learning Malay Online At Tertiary Level									Insufficient	L

Reasons of exclusion (not fulfilling criteria of eligibility) are highlighted in blue

Author	Year	Title	Paper type	DE study (Y/N)	SLL/FLL study (Y/N)	At least 2 DE synchrony (Y/N)	Eligible sample?	Country / region	Education institution?	L1 ➔ L2	Contextual details?	WOE
Wang Szilas, Zhang and Berger	2013	Do Students Share the Same Experience in an Online Language Exchange Programme? – The Chinese-French eTandem Case	Conference paper									L
Teral and Rammo	2014	Online Estonian language learning	Conference paper									L
Uzum	2010	An Investigation of alignment in CMC from a sociocognitive perspective									Insufficient	
Vidal and Thouësny	2015	Computer-Mediated Synchronous and Asynchronous Corrective Feedback Provided by Trainee Teachers to Learners of French: A Preliminary Study	Conference paper								Insufficient	L
Wright	2017	Blended learning: Student perception of face-to-face and online EFL Lessons									Insufficient	
Yang	2013	Discourse Analysis of EFL College Learners' Online Social Interaction and Attitudes towards FACEBOOK									Insufficient	
Yen, Hou and Chang	2015	Applying role-playing strategy to enhance learners' writing and speaking skills in EFL courses using Facebook and Skype as learning tools: A case study in Taiwan					N Non-adult teenage participants (average age of 16)					
Yilmaz and Saglam	2011	Impact of Discussion Boards to the Success of English Lesson									Insufficient	L

Reasons of exclusion (not fulfilling criteria of eligibility) are highlighted in blue