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RESEARCH ARTICLE

Methodological characteristics in technology-mediated task-based language teaching research: Current practices and future directions

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Abstract

In the past two decades, the synergistic relationship among task-based language teaching (TBLT), instructed second language acquisition, and computer-assisted language learning has gained increasing interest. Technology-mediated TBLT combines these three research domains by integrating the use of technology with task-based approaches for second language (L2) learning purposes. Since the emergence of this framework, empirical studies have increasingly explored the incorporation of tasks with technology-mediated settings for L2 learning and teaching purposes. To understand the methodological characteristics of technology-mediated TBLT research to date, we conducted a systematic search and reviewed 254 technology-mediated TBLT studies published between 2000 and 2022 in peer-reviewed journals and book chapters. These studies were coded for methodological features, research foci, and types of technology. We further examined the role of technologies in task performance to identify their effectiveness in creating authentic tasks. The findings revealed that technology-mediated TBLT research investigated a rather limited scope of contexts, learner groups, and linguistic features, with little attention paid to evaluating the quality of task outcomes. The types of technology used were skewed toward computer-mediated communication. The results also showed that studies examined various interactional features, and the majority reported both quantitative and qualitative data. Furthermore, technologies were integrated into task design to create meaningful language use contexts. Based on these findings, we share suggestions for future technology-mediated TBLT research.

Keywords: task-based language teaching; instructed second language acquisition; technology-mediated tasks; research synthesis; computer-assisted language learning

In the current digital age, practitioners and additional stakeholders in second language (L2) teaching have been integrating technology into classrooms to empower learners in a world in which communication via technology is critical for their academic

and professional success (González-Lloret & Rock, 2022). In particular, the surge in online instruction and the use of innovative AI-generated tools have ignited great interest in the application of technology within educational contexts. This study focuses on task-based language teaching (TBLT)—an independent academic domain dedicated to researching and teaching additional languages through tasks (https://www.iatblt.org/). Since González-Lloret and Ortega's (2014b) introduction to the framework of technology-mediated TBLT—a concept that integrates tasks and technology to enhance language learning—there has been an increasing interest in the intersection of educational technology and TBLT (Ziegler, 2016). However, to date, there remains limited knowledge regarding the methodological and substantive features of published empirical studies exploring the intersection of tasks and technology. Thus, this paper systematically reviews empirical studies on technology-mediated TBLT published between 2000 and 2022. It focuses on methodological trends in this domain and provides directions for future research.

Literature review

Technology-mediated TBLT: The intersection between TBLT, (instructed) SLA, and CALL

Various definitions of tasks have been introduced over the last two decades (e.g., Ellis, 2003; Long, 1985). A commonality among them is the need for tasks to "focus on meaning, be goal-oriented, and have an outcome apart from merely practicing the language" (González-Lloret & Rock, 2022, p. 38). Despite critiques of TBLT, several review papers (Ellis, 2017; Long, 2016) and meta-analyses (Bryfonski & McKay, 2019) have emphasized the abundant empirical support for the benefits of using tasks for L2 instruction.

González-Lloret and Ortega (2014b) first introduced the concept of "technology-mediated TBLT" as the integration of tasks and technology for language learning. The incorporation of technology in task-based curricula provides learners with opportunities to improve not only their L2 learning but also their digital literacy and skills in utilizing technological tools, which in turn facilitates their engagement with real-world tasks in the digital world. Compared to more traditional definitions of a task (e.g., Ellis, 2003), the definition of a technology-mediated task should be more encompassing since learners' digital literacy and technological proficiency are necessary for successful task completion and forming social relationships with others in technology-mediated settings (González-Lloret & Ortega, 2014b; González-Lloret & Rock, 2022; Ziegler, 2016).

Technology-mediated TBLT is primarily shaped by three influential fields: TBLT, instructed second language acquisition (ISLA), and computer-assisted language learning (CALL). This section briefly discusses each of the three domains and then explores the intersections of their theories. First, TBLT, one of the most extensively researched L2 pedagogical approaches, has various conceptualizations within the literature. However, the key characteristics that define TBLT is that it is "an approach to course design, implementation, and evaluation intended to meet the communicative needs of diverse groups of learners" (Long, 2015, p. 5). In contrast to other pedagogical approaches, such as the structural approach (which focuses on teaching discrete

grammatical structures), TBLT prioritizes meaning while still addressing form. TBLT emphasizes the significance of engaging learners' natural abilities by promoting incidental language learning through the performance of tasks that draw learners' attention toward the target language rather than solely on the isolated linguistic forms (Ellis et al., 2020). Second, ISLA, known as a sub-field of second language acquisition (SLA), is a research field that aims to "understand how the systematic manipulation of the mechanisms of learning and/or the conditions under which they occur enable or facilitate the development and acquisition of an additional language" (Loewen, 2020, pp. 2–3). The majority of ISLA research is motivated by theories of second language learning such as the interaction approach to language learning (Gass & Mackey, 2020), skill acquisition theory (DeKeyser, 2020), and sociocultural theory (Lantolf et al., 2020). Finally, CALL focuses on the use of digital technology in language learning and teaching. CALL originated as a discussion of professional issues surrounding the use of technology for language instruction by a small group of researchers. However, CALL has since emerged as a prominent focus within applied linguistics, as the growing presence of technology in various aspects of L2 practice—including L2 use, teaching, and teacher education—has consistently driven the development of pedagogical approaches that utilize technology (Chapelle, 2005).

Scholars have discussed the relationships among these three areas, namely between CALL and SLA (Chapelle, 2009; Plonsky & Ziegler, 2016), TBLT and ISLA (Loewen & Sato, 2021), and CALL and TBLT (Ziegler, 2016). Accordingly, researchers have suggested the need for reciprocal collaboration between these research domains at both the theoretical and methodological levels. For instance, Chapelle (1997, 2009) emphasizes the need to firmly ground CALL in SLA theory and methodology since CALL has become an independent research domain. Similarly, Loewen and Sato (2021) claim that both TBLT and ISLA are concerned with L2 learning in instructed settings, and that the ultimate goal of these two fields is to find effective instructional conditions and learning mechanisms. The authors further highlight that they complement each other at the theoretical, empirical, and practical levels and identify the use of technology as a shared future direction for research and practice that can benefit from the field of CALL. Furthermore, tasks have become essential to all three disciplines, serving as both the main unit of instruction and as research tools. Consequently, scholars have highlighted the ways in which CALL research benefits from TBLT, namely providing a theoretical framework to "design more pedagogically effective computer-based activities" (Ziegler, 2016, p. 137). The integration of technology, especially motivated by CALL research, can thus be argued to enrich TBLT as a pedagogy in the modern era where digital skills and tools are indispensable. Theories and empirical evidence of ISLA can also provide foundations for pedagogical interventions. In sum, technology-mediated TBLT can bring these three domains together, facilitating evidence-based language pedagogy using context-appropriate technologies in the current digital age. To better understand the research domain of technology-mediated TBLT, it is imperative to survey the types of technologies that have been utilized when designing tasks and how these tasks have been implemented. Particular attention should be paid to whether technologies are an essential part of task design or mere add-ons to traditional versions of the target tasks.

Research synthesis on technologies and digital space for L2 learning

To date, research syntheses have explored prevalent themes in CALL (Akiyama & Cunningham, 2018; Dehghanzadeh et al., 2021; Dixon et al., 2022; Di Zou & Xie, 2021; Gillespie, 2020; Golonka et al., 2014; Zhang & Zou, 2022). Specifically, some syntheses have reported the methodological features of CALL empirical studies examining a single type of technology, such as synchronous computer-mediated communication (SCMC) tools (Akiyama & Cunningham, 2018) and digital games (Dehghanzadeh et al., 2021; Dixon et al., 2022; Di Zou & Xie, 2021). For example, Akiyama and Cunningham (2018) reviewed 55 telecollaboration studies that utilized SCMC tools in L2 classrooms. The study investigated features including learner demographics, SCMC types, use of asynchronous computer-mediated communication (CMC) tools, and interaction setups. Similarly, Di Zou and Xie (2021) reviewed studies focusing on digital game-based vocabulary learning with a particular interest in the types of digital games and theoretical frameworks adopted in addition to their main research foci (e.g., learning outcomes, motivation, learner behavior), findings, and main implications. Additionally, Dixon et al. (2022) investigated the extent to which digital gaming influenced L2 learning outcomes in 26 empirical studies. Other variables examined in their review included the game developers' intended purpose of the game, outcome measures, and game design features (e.g., type of player interaction).

Few reviews have examined the diverse range of technologies used in CALL research from a more comprehensive perspective, instead of focusing on the methodological features of empirical studies that use a single type of technology (e.g., SCMC, digital games). For instance, Golonka et al. (2014) investigated types of technology and their effectiveness in 350 empirical studies focusing on foreign language learning. The authors categorized technology types as schoolhouse- or classroom-based technologies (e.g., course management system, interactive whiteboard), individual tools (e.g., electronic dictionary, grammar checker, automatic speech recognition), network-based social computing (e.g., virtual worlds, chat platforms, social networking, blog, Wiki), and mobile devices (e.g., tablets, personal computers, cell phones). More recently, Zhang and Zou (2022) examined 51 CALL studies for the main types, purposes, and effectiveness of technologies used to enhance second and foreign language learning. The five primary uses of technologies were (a) mobile-assisted language learning, (b) multimedia language learning, (c) socialized language learning, (d) speech-to-text recognition and text-to-speech recognition-assisted language learning, and (e) gamified language learning.

Finally, syntheses have also focused on research topics that have been investigated in CALL research. For example, Gillespie (2020) conducted a comprehensive review of CALL research published in three CALL journals: *ReCALL, CALICO Journal*, and *Computer Assisted Language Learning*, examining their research topics and methods. His review highlights the relatively small array of topics explored in previous research (e.g., the four language skills, vocabulary, grammar, CMC), leaving cultural content and contexts under-explored. He further noted that most studies were small-scale in terms of study duration, session frequency, sample size, learners' proficiency levels (i.e., beginner or intermediate levels), and number of institutions. Studies also predominantly examined English as the target language.

There have been several syntheses and reviews on technology-mediated TBLT research (Chong & Reinders, 2020; González-Lloret, 2022; Lai & Li, 2011; Ziegler, 2016). To date, a few research syntheses have focused on how technology deepens our understanding of TBLT features using representative studies. For example, Lai and Li (2011) demonstrated that empirical studies have used diverse technological affordances—such as text-based CMC, digital games, blogging, telecollaboration, and emails—to demonstrate that technology can both enhance L2 learning using tasks and enrich our understanding of TBLT features. The review further reported that TBLT serves as a pedagogical framework for advancing the field of technology-mediated language learning. However, the review also pointed to challenges such as learners' need to develop technological skills for task completion, greater need for teacher involvement, and difficulties in researching complex constructs (e.g., learner agency, digital literacy). Ziegler (2016) also reviewed technology-mediated TBLT studies to understand how technology can support L2 development in task-based settings and how it contributes to our knowledge of TBLT and L2 learning processes. The findings revealed a growing body of studies supporting the positive effects of technology-mediated tasks. Tools such as multiplayer games, virtual worlds, online collaborations, and social networking were identified as not only supporting L2 acquisition but also positively influencing L2 learners' attitudes toward technology. Ziegler emphasizes a need for more research on emerging multimodal and immersive environments as opposed to further investigations of written text chats.

In a later study, Chong and Reinders (2020) adopted a grounded theory approach to synthesize the findings of 16 qualitative task-based studies. The synthesis identified the characteristics, affordances, limitations, and factors impacting the effectiveness of technology-mediated TBLT in naturalistic, classroom-based studies. The results showed that technology-mediated TBLT facilitates collaboration, interaction, and communication, thereby cultivating positive effects toward language learning, facilitating student-centered learning, and developing linguistic and nonlinguistic skills. The study also shared limitations, such as teachers' difficulties in implementing technological tasks and learners' concerns regarding lack of explicit grammar instruction and heavy workload.

Syntheses have also investigated the general trends in technologies used in task-based settings over time. For instance, focusing on L2 pragmatic competence, González-Lloret (2022) presented a historical overview of the types of technologies used in empirical task-based studies. She reported that studies involving pragmatics follow the general trend in CALL research of examining text CMC and, more recently, oral CMC. These studies often involve telecollaboration between two remotely located institutions. Moving toward more innovative technologies, studies have used multimodal affordances such as video scenario-based computer simulations, games, synthetic environments, and social networks. González-Lloret (2023) chronicled the history of technology use in language education based on publications in *System* from 1970 to 2023, focusing on the emergence of technologies. She emphasizes that "technology has been 'normalized' in language education research, and its place in academia is now as ubiquitous as it is in our lives" (p. 8).

Despite the increase in research syntheses on the use of technology in language learning, no systematic review paper has yet focused on technology-mediated TBLT

as a whole, emphasizing the following features: empirical research design, various task-related focal constructs, and types of technology implemented in task design. Thus, there is a need to review the methodological and substantive features of previous empirical technology-mediated TBLT studies to understand the trend of research foci and to guide future research directions more comprehensively.

The current study

The overarching goal of the current review paper is three-fold: (a) to survey the research contexts, learner demographics, and methods in technology-mediated TBLT studies; (b) to examine the main research constructs that have been investigated in previous technology-mediated TBLT research and the measurements used; and (c) to explore the types of technology or digital spaces utilized in previous research and to evaluate their essentiality in task performance. The research questions guiding this study are as follows:

(1) What are the characteristics of previous technology-mediated TBLT research in terms of research contexts, learner demographics, and research methods?
(2) What research foci have been examined in previous technology-mediated TBLT research? What measurements have been used to examine these focal constructs?
(3) What types of technology or digital spaces have been used in previous technology-mediated TBLT studies? How essential was technology to task performance in these studies?

Methodology

Inclusion criteria and search techniques

The first stage of data collection involved a comprehensive search using three databases: Linguistics and Language Behavior Abstracts, Education Resources Information Center, and Google Scholar. There are various ways to implement tasks in syllabus design, and different terminologies have been introduced to describe how tasks are used in curriculum design. For instance, tasks can be the main unit of instruction in TBLT or a supplementary affordance in task-supported language teaching (task-based vs. task-supported; Samuda & Bygate, 2008). Notably, the term "task-based" has been "loosely applied as an umbrella term to refer to any context in which tasks are used" (Samuda & Bygate, 2008, p. 57). As the purpose of this study is not to examine research at the curricular level, we adopted this looser conceptualization of "task-based." In other words, we used "task-based" to refer to any instructional or research context in which tasks were used for language learning purposes. Using the advanced search function, we searched for the combinations of the keywords "task-based" OR "TBLT" AND "technology." We conducted another search using "technology-mediated TBLT." This study only included peer-reviewed journal articles and book chapters. In addition to the keywords listed above, we screened studies using the following criteria:

(1) published between 2000 and 2022;
(2) referred to their instructional material as a "task" throughout the paper;

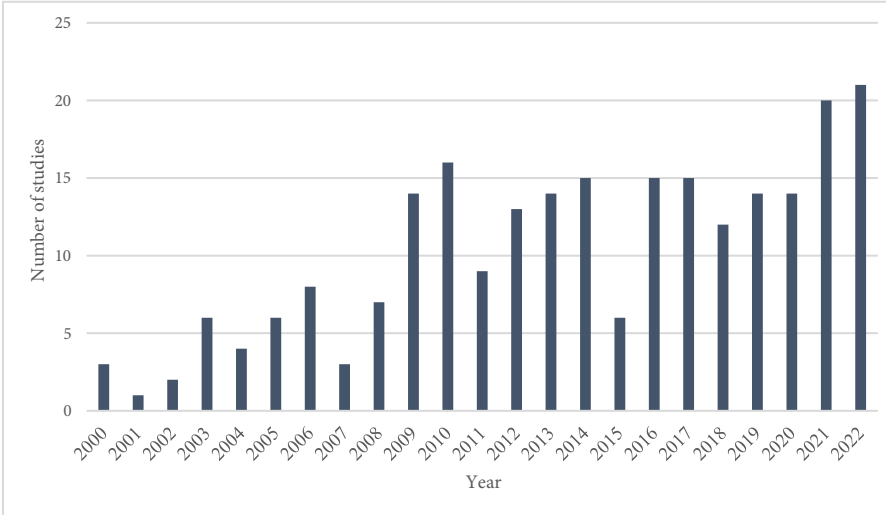

Figure 1. Studies of technology-mediated TBLT from 2000 to 2022.

(3) utilized technology, such as computers, mobile phones, or tablets (studies utilizing analog tools, such as audio tapes or CD-ROMs were excluded from the dataset);
(4) reported empirical data related to technology-mediated tasks (studies that focused on the evaluation of a task-based language program, teacher training, L2 assessment or assessment tools, and the foundation of a task-based curriculum starting from a needs analysis were excluded);
(5) conducted in L2 contexts; and
(6) written in English.

Studies that utilized the same data but investigated different research questions or goals were included separately (e.g., Abe & Roever, 2019, 2020). Moreover, corpus-based studies that referred to their instructional materials for data elicitation as "tasks" were included (e.g., Black & Barron, 2018).

The second stage of data collection involved a manual search of studies in four CALL-specific journals (*CALICO Journal, Computer Assisted Language Learning, Language Learning & Technology, ReCALL*) and two edited books (*Task-based Language Learning and Teaching with Technology* edited by Thomas & Reinders (2010) and *Technology-mediated TBLT: Researching Technology and Tasks* edited by González-Lloret & Ortega (2014a)). A total of 254 empirical studies were included in the dataset (the full list of studies is provided in IRIS [instruments and data for research in language studies]). Figure 1 illustrates the increase in the number of studies from 2000 to 2022.

Data coding

A coding scheme was developed to extract information relevant to the research questions of this study (see Table 1). To evaluate the essentiality of technology in

Table 1. Coding scheme

Category	Variables
Study identification	Author(s)*; year of publication*; title of journal/book*; title of article*
Research context and learner demographics	Language learning context; educational setting; research setting; target language; proficiency (as stated by the authors)
Research design and methodology	Sample size*; number of tasks*; research methodology; statistical analysis
Data analysis, measurements, and findings	Research question/goal*; research foci; target interactional feature; target language feature; learner perception measurement; learning outcome measurement; research findings*
Technology	Type of technology; kind of program*; essentiality of technology

Note: All items were coded numerically (e.g., *foreign language* = 1, *second language* = 2, *not specified* = 3) unless marked with * to indicate items with an open-ended response. Also, if the author(s) provided the Common European Framework of Reference for Languages (CEFR) level, proficiency was categorized accordingly based on the CEFR level description.

Table 2. Criteria for essentiality of technology

Technology-essentiality	Definition
Technology-optional	Technology is optional when performing the task. The tasks involve the use of technology, but technology is not obligatory to complete the task. The tasks are considered translations or extensions of exercises or activities that have been adapted to computer platforms (e.g., engaging in digital games that incorporate drills focusing on form).
Technology-facilitated	Technology is not necessarily essential to complete the task, but it facilitates task performance. Technology plays a key role in implementing the task (e.g., performing a jigsaw task through SCMC platforms in laboratory settings, completing tasks asynchronously).
Technology-essential	Technology is essential to perform the task, as it is a critical part of the task design. The tasks and technology are effectively integrated in an organic way (e.g., writing emails, synchronously collaborating on writing, interacting with other users in immersive environments or games, receiving computerized feedback, telecollaborating with others in remote locations via SCMC platforms).

performing tasks, we developed a coding scheme to classify each study based on the extent to which technology was essential for learners to complete the task. The purpose of evaluating the essentiality of technology was to investigate whether research has been effectively integrating new technologies with language tasks in an organic and mutually informative way, considering the reciprocal relationship between TBLT and technology (González-Lloret & Ortega, 2014b). Table 2 presents the definitions of each value for technology essentiality (i.e., technology-optional, technology-facilitated, technology-essential).

To ensure the reliability of coding, two raters coded selected features in the coding scheme. The first rater was the second author of this study, and the second rater was a Ph.D. student in Applied Linguistics. Both raters received formal training in TBLT through graduate-level courses and are familiar with the TBLT literature. The raters evaluated 32% of the empirical studies included in the dataset ($n = 82$) independently

on the following features: research methodologies, statistical analyses, essentiality of technology (see Table 2), research foci, measurements (learner perception, learning outcome), and target interactional and linguistic features. The exact agreement for coding these features reached 90.03%. Discrepancies were negotiated through multiple discussion sessions with the first author, and all the remaining data, including other discrete items, such as sample size, were coded by the first rater.

Data analysis

The 254 primary studies were coded in Excel for an array of methodological and substantive features. The frequencies of each feature were then counted, and the percentages relevant to each research question were calculated. The percentages were rounded to the nearest whole number.

Results

To answer the first research question, we surveyed the studies focusing on their language learning context, educational setting, research setting, target language, and learners' target language proficiency. As demonstrated in Table 3, previous technology-mediated TBLT research has noticeably favored foreign language contexts (80%),

Table 3. Research contexts and learner demographics

Descriptor	*k*	%
Language learning context		
Foreign language	203	80
Second language	46	18
Not specified	5	2
Educational setting		
K–12	18	7
University	208	82
Graduate	8	3
Language institute	18	7
Other*	7	3
Not specified	3	1
Research setting		
Classroom	164	65
Laboratory	90	35
Target language		
English	168	66
Spanish	51	20
German	17	7

(*Continued*)

Table 3. (*Continued.*)

Descriptor	*k*	%
French	11	4
Chinese	11	4
Japanese	7	3
Russian	4	2
Dutch	2	1
Korean	2	1
Italian	2	1
Other**	4	2
Proficiency		
Beginner	54	21
Intermediate	153	60
Advanced	49	19
Used as a variable	6	2
Not specified	40	16

Note: The percentages were calculated by dividing *k* by 254. The percentages for educational setting, target language, and proficiency do not add up to 100%, as some studies investigated more than one item.
*Other educational settings included online recruitment ($k = 5$), refugees ($k = 1$), and adult learners living in the UK ($k = 1$).
**Other target languages included Arabic, Croatian, Irish, and Māori ($k = 1$ for each target language).

with university students (82%) learning English as the target language (66%) in classroom contexts (65%). Regarding learner proficiency level, intermediate-level learners (60%) have been most investigated, though 16% of the studies did not report learners' proficiency.

Regarding the characteristics of their research design, technology-mediated TBLT studies have involved approximately 45 participants on average, though a large variance in sample size ($SD = 82.74$) was observed, ranging from 2 to 1,150 participants. Furthermore, previous research has used 3.68 tasks on average ($SD = 4.93$), ranging from 1 to 48 tasks. However, 43 studies (17%) out of the 254 studies did not state the number of tasks used in their research.

With respect to research methodology, Table 4 shows that technology-mediated TBLT research has favored a mixed-methods approach (63%). An examination of the statistical tests used in the studies adopting a quantitative method or a mixed-methods approach revealed that virtually all of them utilized descriptive statistics (99%) to report their findings. Furthermore, such research has used statistical tests, including *t*-tests (25%), ANOVA (23%), and nonparametric tests (11%), to analyze data. Of the quantitative-only and mixed-methods studies that used inferential statistics ($k = 135$), less than one-fifth of the studies (16%, $k = 22$) incorporated post hoc tests, and less than half (46%, $k = 62$) reported effect sizes.

The second research question pertained to the research foci of previous technology-mediated TBLT research (see Table 5). Over half of the studies investigated learner perception (56%), whereas less than one-third of the studies explored learning outcomes (30%). Additionally, out of the 254 studies, 38 (15%) investigated learner perspectives as dependent variables.

Table 4. Research methodologies and statistical analyses

Descriptor	*k*	%
Research methodology		
Qualitative only	33	13
Quantitative only	61	24
Mixed-methods	160	63
Statistical analysis		
Descriptive statistics	219	99
t-test	56	25
ANOVA	50	23
Nonparametric test	25	11
Correlation	18	8
Chi-square	17	8
Regression	17	8
MANOVA	8	4
ANCOVA	7	3
Other*	3	1

Note: We considered descriptive statistics as a quantitative method. Thus, a qualitative study that included frequency/percentages was counted as a mixed-methods study. The percentages of statistical analyses were calculated by dividing *k* by the number of studies adopting a quantitative method or a mixed-methods approach ($N = 221$). The total percentage of statistical analyses does not add up to 100% as studies often used more than one statistical test.
*Other statistical tests included MANCOVA ($k = 1$) and factor analysis ($k = 2$).

Table 5. Research foci

Descriptor	*k*	%
Analysis of learner perception	143	56
Analysis of learning outcome	77	30
Analysis of task performance	187	74
Interactional features	126	67
Linguistic performance during tasks	62	33
Quality or nature of task outcome	33	18
Social and intercultural aspects (e.g., pair dynamics, intercultural awareness)	28	15
Use of technology (e.g., scrolling, clicking)	20	11
Other (e.g., number of turns, time-on-task)	15	8
Analysis of learner perspectives	38	15
Motivation	10	26
Engagement	9	24

(*Continued*)

Table 5. (*Continued.*)

Descriptor	*k*	%
Anxiety	6	16
Autonomy	6	16
Willingness to communicate	2	5
Agency	2	5
Other (e.g., self-efficacy, flow)	8	21

Note: The percentages for each descriptor were calculated by dividing *k* by 254. The total percentage of the studies does not add up to 100%, as some had multiple research foci. The percentages of task performance components were calculated by dividing *k* by 187, and the percentages of learner perspective components were calculated by dividing *k* by 38.

When analyzing learners' task performance, interactional features were extensively investigated (67%) in this research domain. As shown in Table 6, a closer look at these interactional features revealed that feedback (31%) received the greatest attention, followed by negotiation of meaning (25%) and language-related talk (24%) commonly operationalized as language-related episodes (LREs).

Table 6. Interactional features examined

Target interactional feature	*k*	%
Feedback	39	31
Negotiation of meaning	32	25
Language-related talk (e.g., LREs)	30	24
Strategy (e.g., intersubjectivity strategy, compensatory strategy)	17	14
Edits (in writing)	10	8
Repair	8	6
Noticing	7	6
Modified output	6	5
Alignment	5	4
Uptake	5	4
Nonverbal components (e.g., gestures)	5	4
Translanguaging/L1 use	4	3
Off-task discussion	3	2
Content-related talk	2	2
Multimodal episode	2	2
Other (e.g., holistic language unit, modified input, pragmatic play)	6	5

Note: The percentages were calculated by dividing *k* by 126. The total percentage does not add up to 100%, as some studies investigated multiple interactional features.

Furthermore, we analyzed the language features that were examined in previous research (see Table 7). Vocabulary (42%) and grammar (38%) were most investigated. In addition, CAF measures were predominantly examined (51%). In particular, complexity (25%; written: $k = 20$; oral: $k = 7$) and accuracy (17%; written: $k = 18$; oral: $k = 7$) were examined more often than fluency (9%; written: $k = 10$; oral: $k = 5$).

Table 7. Language features examined

Target language feature	*k*	%
Vocabulary	79	42
Grammar	71	38
Complexity		
Syntactical	26	14
Lexical	20	11
Accuracy	31	17
Fluency	16	9
Pragmatics/interactional competence	23	12
Pronunciation/phonology	14	8
Speaking skill	14	8
Writing skill	10	5
Listening comprehension	5	3
Proficiency (in general)	3	2
Reading skills	2	1
Other (e.g., language for cohesion)	4	2

Note: The percentages were calculated by dividing *k* by 187, as 67 studies out of 254 did not examine language features but investigated only learner perception, learner perspective, and/or interactional features with no linguistic foci (e.g., gestures). Also, in our analysis, if a study investigated LREs on grammar or vocabulary, we coded the target linguistic features as grammar and vocabulary, respectively. The total percentage of the studies does not add up to 100%, as some investigated multiple language features.

Among the research foci identified, learner perception and learning outcomes were observed with various operationalizations. Thus, we delved deeply into the measurements used to operationalize each construct (see Table 8). Studies examining learner perception predominantly used surveys/questionnaires (71%) followed by interviews (48%). Notably, we found that less than half of the studies ($k = 61$, 43%) triangulated the data to investigate learner perception by utilizing multiple measurements. Furthermore, studies investigating learning outcomes mostly used receptive tests (35%), oral productive tests (30%), and written productive tests (30%). We also observed that 30 out of the 77 studies (i.e., 39%) examining learning outcomes adopted multiple tests to examine different knowledge types.

Table 8. Measurements of learner perception and learning outcome

Descriptor	*k*	%
Learner perception measurement		
Survey/questionnaire	102	71
Interview	68	48
Written report/reflection/diary	22	15
Stimulated recall	16	11

(*Continued*)

Table 8. (*Continued.*)

Descriptor	*k*	%
Observation (field notes)	16	11
Think aloud	2	1
Learning outcome measurement		
Receptive test	27	35
Oral productive test	23	30
Written productive test	23	30
Task (as pre- and posttests)	11	14
Definition suppliance test	5	7
Correction test	5	7
Written cloze test	5	7
Translation test	4	5
Other (e.g., recall test, pronunciation test, spelling test)	13	17
Not specified	2	3

Note: The percentages for learner perception and learning outcome measurements were calculated by dividing *k* by the number of studies that investigated learner perception ($N = 143$) and learning outcomes ($N = 77$), respectively. The total percentage of the studies does not add up to 100%, as some used multiple measurements.

Finally, the third research question addressed different types of technology or digital spaces that have been examined in previous research. As shown in Table 9, studies have mostly focused on text-based SCMC (34%), video-based SCMC (20%), and Web 2.0 tools (16%), followed by asynchronous CMC (15%). We also observed that 14% ($k = 35$) of the 254 studies focused on tandem learning and telecollaboration. In these studies, learners performed tasks with native or more proficient speakers of the target language using digital technologies. Upon closer examination of the 35 studies out of the 254 that focused on tandem learning and telecollaboration, it was found that 13 of them utilized video-based SCMC (37%), 10 utilized text-based SCMC (29%), 7 utilized asynchronous CMC (20%), and only 1 utilized audio-based SCMC (3%). A few studies also used social media tools, such as Facebook ($k = 3$, 9%), and Web 2.0 tools, such as Blogger ($k = 1$, 3%), to investigate tandem learning and telecollaboration. Additionally, previous studies have used diverse platforms when incorporating technologies with tasks. For example, regarding SCMC studies, recent research has commonly used software such as Skype, Moodle, Zoom, Facebook Messenger, and WebEx, while the earlier studies frequently used platforms such as ChatNet, WebCT, mIRC, and iChat. As for Web 2.0 tools, studies have used platforms such as Google Docs, Facebook, and Wikis.

Using open-source websites available on the Internet, some of the more recent studies developed their own tasks in creative ways instead of utilizing those already developed in earlier research to facilitate negotiated interaction (e.g., jigsaw, spot-the-difference, decision-making). For example, Timpe-Laughlin and Dombi (2020) developed a fully automated, interactive oral task to examine L2 learners' request-making strategies using HALEF (Help Assistant–Language-Enabled and Free; http://halef.org),

Table 9. Types of technology or digital space

Type of technology or digital space	*k*	%
Text-based SCMC	85	34
Video-based SCMC	50	20
Web 2.0 tools for collaborating, editing, and sharing (e.g., Google Docs, Blogger, Wikis)	41	16
Asynchronous CMC (e.g., email, learning management system)	37	15
Virtual world	22	9
Audio-based SCMC	21	8
Digital multimedia tool (e.g., Adobe Spark, PowerPoint, video-creating tools)	15	6
Digital game	14	6
Mobile application (e.g., Hello English, ChinesePod)	8	3
The device itself (e.g., computer, iPad, PDA)	7	3
Social media (e.g., Facebook, Instagram)	5	2
Internet search engine	3	1
Dialogue system/chatbot	3	1
Computerized feedback	2	1
Fanfiction/digital storytelling	2	1
Digital kitchen (i.e., a sensor-based, computer-assisted learning environment facilitating physical interactions during cooking task performances)	2	1
Other*	2	1

Note: Two studies were excluded from the coding of the type of technology, as they did not provide sufficient information about what technology or digital space was used. Thus, the percentages were calculated by dividing *k* by 252. Also, the percentages do not add up to 100%, as some studies focused on multiple types of technology.
*Other types included an online dictionary ($k = 1$) and a concordancer ($k = 1$).

an open-source, web-based framework for designing the spoken dialogue system tasks (Ramanarayanan et al., 2017). The tasks required learners to call a fictitious supervisor and to make two requests (e.g., schedule a meeting, ask for a review of documents). Another example of a creatively constructed task is from Cornillie et al. (2021), which utilized Twine (http://twinery.org), an open-source tool for telling interactive stories. Twine was used to examine L2 learners' writing of interactive fanfiction based on a digital game series. Additionally, researchers have also developed their own software, platforms, or games using programming skills. For example, Taguchi et al. (2022) developed a game using Python to examine L2 learners' acquisition of request-making forms.

The third research question further addressed whether the technologies utilized in the studies were chosen and incorporated into task design in recognition of the mutual relationship between TBLT and technology (González-Lloret & Ortega, 2014b). Table 10 shows that most studies used technology as an essential part of task

Table 10. Evaluation of the essentiality of technology

Essentiality of technology	*k*	%	Sample task and technology
Technology-optional	4	2	• Inserting English articles in gaps in a digital gaming context (Kao, 2020)
Technology-facilitated	78	31	• Jigsaw and decision-making tasks in pairs in computer labs via ChatNet (a text-based SCMC tool) (Smith, 2005) • Listening to audios via an iPod to answer listening comprehension questions (Fuente, 2014)
Technology-essential	170	68	• Collaboratively writing the solutions to a problem on Google Docs while orally discussing over Zoom (Aubrey, 2022) • Playing a game in which players have to choose the best response in given video-based scenarios (Taguchi et al., 2022)

Note: Two studies were excluded from the dataset when coding the essentiality of technology, as they did not provide sufficient information about their technology. Thus, the percentages were calculated by dividing *k* by 252. The percentages add up to over 100%, as the percentages were rounded to the nearest whole number.

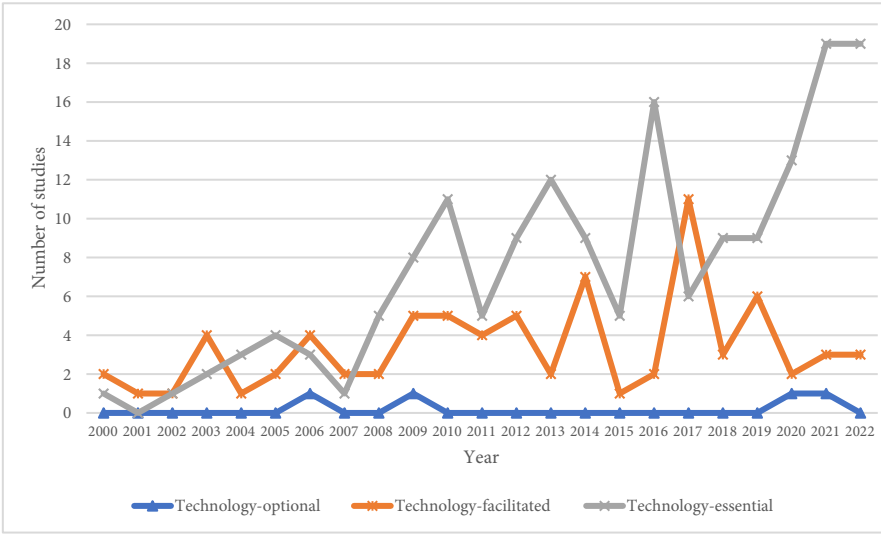

Figure 2. Trend of technology-essentiality from 2000 to 2022.

performance (68%). Also, Figure 2 presents how technology-essentiality has changed from 2000 to 2022. The findings show that technology-essential studies have sharply increased since 2007, while technology-facilitated studies demonstrated a smaller increase over time.

Discussion

The overarching goal of the current study was to understand the methodological and substantive trends of technology-mediated TBLT research published between 2000 and

2022. Some of the findings are encouraging, but others are cause for concern in that they highlight neglected areas of research. In this section, we discuss the findings and provide suggestions for future research.

In terms of the first research question, the findings revealed that research contexts and learner backgrounds are skewed, which is in line with previous systematic review papers in applied linguistics. For instance, Plonsky's (2023) synthetic analysis of 308 applied linguistics research articles found that university students (39%), intermediate level learners (31.65%), and adult learners (41.94%) are the most widely researched groups in terms of sampling-related features. The recent growing interest in research syntheses has allowed us to notice the trends of current sampling practices in addition to researchers' shared concerns regarding their implications at the ethical, theoretical, and practical levels (Andringa & Godfroid, 2020; Ortega, 2005; Plonsky, 2023). Our findings were not an exception, and we agree that this is the result of accessibility and convenience sampling (Plonsky, 2023). With the explicit efforts for multilingual turns in SLA coupled with diversity and inclusion initiatives in educational research, we hope that future research will involve more diverse populations and instructional contexts in this research domain.

Regarding the treatment of research methods, we used a rather lenient standard for classifying research as mixed-method (i.e., reported both quantitative and qualitative data), although they might not have followed protocols of mixed-methods (Creswell & Clark, 2017). This resulted in a notable presence of mixed-method studies that were mainly qualitative in nature but incorporated descriptive statistics to report frequencies of target observations ($k = 85$; e.g., Ziegler & Phung, 2019). For the types of statistical tests used in these studies, the results showed a wider variety of statistical tests used in the technology-mediated TBLT literature compared to previous CALL or TBLT synthesis results (e.g., Plonsky & Kim, 2016). However, similar to Plonsky and Kim's (2016) report, most studies used tests of mean differences between or among groups, such as ANOVA, *t*-tests, and nonparametric tests. Since the importance of reporting effect sizes in L2 research has been increasingly addressed, many journals now require effect sizes (e.g., *Language Learning, Studies in Second Language Acquisitio*n). Interestingly, less than half of the studies (46%) reviewed reported effect sizes, despite this becoming a norm in quantitative research. We would like to note that this relatively low percentage can be attributed to the wide range of time covered by our dataset, spanning from 2000 to 2022, during which the reporting standards may have continued to evolve.

With respect to the second research question, the findings of our review showed that studies have extensively investigated learner perception. Given the relatively innovative nature of learning a language via technology in contrast to traditional paper-based approaches, we believe that researchers have mainly focused on examining learners' acceptance of technology and their perceptions regarding its effectiveness. Also, a few studies in our dataset examined learners' learning outcomes through perception data (perceived learning outcomes; e.g., Batardière, 2013). As new technologies may result in positive "novelty" effects (i.e., a more positive perception due to an instrument's newness or uniqueness), the interpretation of learner perception data, especially in a short-term project, necessitates caution. Furthermore, more longitudinal projects are warranted to understand learner perception dynamics toward technology-mediated TBLT over time (e.g., Kim et al., 2017).

Although the definition of "task" involves a clear, tangible outcome, surprisingly, our analysis revealed that only 18% of the studies focusing on task performance examined the quality of task outcomes systematically by utilizing a rubric or qualitatively describing the task outcomes. As shown in Table 7, the linguistic performance of task outcomes has been widely examined, partly due to the interests associated with CAF measures. Although such linguistic measures could provide insights on potential language development through task performance, the holistic quality of task output, in addition to language quality, needs further attention, especially from task-based assessment perspectives. Furthermore, despite the integration of tasks with technology, there was limited investigation into the actual use of technology during task performance (11%), such as scrolling, clicking, and using online resources. To better understand how technology can be effectively integrated into language-learning tasks, future research is warranted regarding learners' use of technology. Also, while the field of SLA has emphasized the significance of individual factors (Li et al., 2022), there has been relatively less focus on analyzing learner perspective data in technology-mediated TBLT research (15%) compared to analyses of learner perception (56%), learning outcome (30%), and task performance (74%). Out of the various learner perspective studies, however, we were able to observe a recent increase in studies investigating motivation (Canals, 2020) and engagement (Dao et al., 2021).

In terms of the linguistic features that were investigated, the trends in technology-mediated TBLT research included in this synthesis aligned with those found in Plonsky and Kim (2016). The more traditional aspects of language, such as vocabulary, grammar, and CAF measures, received primary attention compared to other features, such as pragmatics/interactional competence and pronunciation/phonology. In terms of the CAF model, written output was examined more often than spoken task performance, particularly focusing on accuracy and on complexity at the syntactic and lexical levels. Thus, we would like to highlight the need to expand the research domain by including other dimensions of task performance, such as *functional adequacy* (i.e., how successful a learner's task performance is in achieving task goal efficiently). Furthermore, previous research has tended to focus more on productive skills rather than receptive skills, overlooking input-based tasks. As highlighted in Gillespie's (2020) synthesis of CALL research, technology-mediated TBLT research would also benefit from expanding the scope of research topics and focusing on higher level critical thinking skills by moving beyond the examination of linguistic performance during tasks. Regarding interactional features, a wider array was investigated than those found in Plonsky and Kim (2016), probably due to the ever-expanding technological affordances accessible in technologies (e.g., nonverbal communication during videoconferencing, alignment during text-chats) available since that synthesis was conducted.

The last goal of the current review was to delve into the types of technologies used in technology-mediated TBLT research and their implementation. The findings revealed that SCMC (either text-based or video-based) and Web 2.0 tools have been most widely used in technology-mediated TBLT research. This trend has been observable over the last two decades in SLA's research agenda. For instance, there has been a surge in research comparing face-to-face and SCMC interactions in terms of learner noticing (Gurzynski-Weiss & Baralt, 2015), feedback (Rassaei, 2017), and learner engagement (Baralt et al., 2016). Additionally, a growing interest in technology-mediated collaborative writing tasks is reflected in the high percentage of research articles using

Web 2.0 tools (Abrams, 2019). Moreover, multimodal approaches to conceptualizing and teaching L2 writing are on the rise, and the use of digital multimodal composing tasks has been increasingly studied in the field of TBLT (Kim et al., 2022). Furthermore, studies have increasingly investigated L2 learning via simulations in virtual worlds, using tools such as *Second Life* (Chen & Kent, 2020) and *Mondly VR* (Tai, 2022). Overall, it seems clear that novel technologies were introduced not only due to the diversifying functions of technologies but also to tap into different theoretical motivations of research associated with such technologies.

Moving forward, future technology-mediated TBLT research should diversify the types of technologies investigated, as CMC tools have been a primary focus (approximately 70%). It is important to note that our dataset did not include studies published in 2023, a year that has seen a marked increase in interest related to the use of AI technologies. Thus, we expect more research using AI-assisted tools in the near future given the recent advances in AI technologies and their applications to language education (Godwin-Jones, 2023). Furthermore, we would like to highlight the significance of collaboration between TBLT researchers and instructional technology and CALL experts, as oftentimes the observed lack of up-to-date technology use in TBLT could be due to the boundaries between different disciplines. For instance, immersive VR environments and metaverse platforms have been increasingly implemented in instructional designs in the field of instructional technology (e.g., Lee et al., 2023). Such technology-mediated language learning platforms offer ideal settings for designing authentic tasks because they can create immersive learning experiences that closely resemble real-world situations for L2 learners, particularly in foreign language learning contexts. Instructional technology and CALL researchers could create more theoretically and pedagogically sound technology-mediated tasks through the adoption of a TBLT framework. Conversely, through collaboration with scholars from instructional technology and CALL, TBLT researchers can gain valuable insights on more diverse and innovative instructional technologies. By overcoming disciplinary boundaries, scholars in CALL, ISLA, and TBLT can engage in reciprocally beneficial relationships.

González-Lloret and Ortega (2014b) highlighted that technology-mediated TBLT introduces a new understanding of technology and task integration in that technology should be "yoked with real tasks rather than being chosen as mere translations or extensions of exercises and activities of various kinds into computer platforms" (p. 5). As the role of technology is critical in technology-mediated TBLT, we examined how different technologies were used in task design and implementation and proposed three categories: *technology-optional, technology-facilitated*, and *technology-essential*. We find it encouraging that the technologies represented in this synthesis were used organically as a part of tasks and facilitated authentic language use and interactions. Technology-essential tasks included writing academic papers with peer feedback on Moodle (Payant & Zuniga, 2022), collaborative writing with synchronous teacher feedback on Google Docs, (Shintani, 2016), and real-world simulated interactive tasks using avatars (Chen & Kent, 2020).

Limitations of the synthesis

One of the main limitations of the present study is that it did not investigate the extent to which the tasks in the reviewed studies adhere to the definition of tasks from

TBLT perspectives (González-Lloret & Ortega, 2014b). Although technology might have been organically integrated into task design in previous research, as shown in this review, there needs to be a standardization of the operationalization of tasks in the technology-mediated TBLT literature so that there is a consensus on what tasks are across the three research domains (TBLT, instructed SLA, CALL). Also, new technologies have transformed what counts as "real-world" within the traditional TBLT perspective (Ortega & González-Lloret, 2015), and this requires us to rethink what constitutes a task in the digital age. Thus, the next step to take within this line of research is to investigate whether the tasks in technology-mediated TBLT studies meet the criteria of a task, and particularly what types of technology-mediated task features promote learning opportunities and subsequent learning. Furthermore, the current review only incorporated studies published in English, which is a common constraint in synthetic research across the field of applied linguistics. As a result, the findings in this paper should not be considered a comprehensive representation of all technology-mediated TBLT studies, as there are many studies written in other languages that have examined the incorporation of tasks with technology.

Conclusion

This study systematically reviewed 254 technology-mediated TBLT studies published between 2000 and 2022. We observed a large number of studies reporting both quantitative and qualitative data. Additionally, a great number of the studies were technology-essential, meaning they organically integrated tasks with technology. Previous research has also investigated a wide variety of interactional features during task performance due to the availability of diverse technological affordances. A concern, however, is that studies in this area have primarily focused on a limited range of educational contexts, target languages, and proficiency levels. Similarly, little attention has been given to assessing the quality of task outcomes and learner perspectives compared to learner perceptions and learning outcomes. Furthermore, the target language features investigated are also rather limited, overlooking higher-level language skills and cultural aspects. Finally, the types of technology were greatly skewed toward CMC, and we call for more studies on different types of technology to be conducted so as to better represent the diversification of authentic target language domains in the digital age. Although efforts were made to include many studies that integrate technology and tasks, we would like to acknowledge that the dataset included in this study should not be considered an exhaustive list of technology-mediated TBLT studies. Despite the limitations, our findings demonstrate the need for increased dialogues and research collaborations among CALL, ISLA, and TBLT researchers. Such reciprocity could produce theoretically and pedagogically sound research with carefully designed technology-essential tasks, which in turn could provide valuable insights that inform language pedagogy in the current digital era.

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*Note: * indicates the studies that were included in the current review.*

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