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THINKING ALLOWED

Technology-mediated task-based language teaching: A research agenda

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Abstract

This paper discusses key concepts in the emerging field of technology-mediated task-based language teaching (TMTBLT) and provides a research agenda for moving this sub-field forward in a theoretically sound and data-driven way. We first define TMTBLT and discuss the importance of considering technological affordances and specific learning contexts when matching individual technologies with particular tasks. We then explore the notion of task, specifically task complexity and sequencing, and how the introduction of technology may interact and modify tasks' features. Next, we examine the use of mobile apps and social media within a task-based language teaching (TBLT) framework and highlight areas primed for exploration or in need of reconciliation. Finally, we call for TMTBLT studies to capture and evaluate learner process data. Within each area above we propose a series of specific research tasks that incrementally build on previous research in both face-to-face and technology-mediated environments, which may help us better understand how tasks and technologies intersect to promote language learning.

1. Introduction

1.1 Technology-mediated TBLT

Developing out of the fields of TBLT and computer-assisted language learning (CALL), the field of TMTBLT has emerged as a new and important area of inquiry in applied linguistics. It boasts a growing body of research that will soon allow us to aggregate results and better answer important questions at the intersection of technology and task-based teaching/learning. As with any young area of inquiry, there are dozens of research questions and avenues of investigation that are important to explore. We have chosen a few of the most pressing hurdles that need to be overcome to move this sub-field forward in a theoretically sound and data-driven way.

It is important to emphasize from the outset the difference between 'technology-mediated' and 'technology-enhanced' tasks. While most contexts may incorporate some use of technology as part of the second language (L2) curriculum, a technology-mediated TBLT curriculum is based on the full integration of technology and tasks (González-Lloret & Ortega, 2014). In the TBLT literature, tasks have been conceptualized on a continuum from communicative activities that can accompany more traditional form-focused approaches (Ellis, 2009) to more authentic everyday life activities that reflect real-world activities and interactions (Long, 1985, 2016). Much of the research from the TMTBLT approach uses tasks such as information gap tasks, narration tasks, agreement tasks, that, depending on the teaching context, can be more or less authentic and/or relevant for the learners. Regardless of the definition or version of TBLT, several common criteria define a task. At a minimum, tasks need to focus on meaning (rather than linguistic forms) and they should be outcome-based; that is to say, there should be a reason to use the language beyond the activity itself. As González-Lloret and Ortega (2014) suggest, tasks in TMTBLT should be defined by five key features: (1) they should focus on meaning, even if there is a preplanned language goal, this goal should be 'hidden' within the task; (2) they should be goal-oriented with a clear communicative goal and outcomes resulting from the task; (3) the task should be based on

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learners' wants and needs and allow learners to use a variety of linguistic and non-linguistic resources to complete the task; (4) the task should be holistic, in the sense of being as authentic and relevant as possible to the learners and directly related to the world outside of the classroom; and (5) tasks should involve cycles of reflection to engage learners in intellectual knowledge and personal growth.

The steps in developing a TMTBLT curriculum include first conducting a needs analysis, which will allow us to identify and classify target tasks into general task types. These tasks must then be designed in ways that are likely to elicit learner behavior thought to be facilitative of language learning, while staying within the TBLT requirements related to ecological validity and authenticity. Ultimately, the nature of learner interaction (either with an interlocutor or computer interface of some sort) should predictably vary as a function of task structure, complexity, etc. In TMTBLT, curriculum designers and practitioners must consider both language tasks and technology tasks, which command equal importance. For example, in a Spanish for business communication course, a pedagogic language-focused task may focus on appropriately greeting clients in Spanish when writing a letter or on the phone. The pragmatic focus may be on the level of formality employed in each and the task may culminate in students using appropriate greetings and closings while collaboratively writing a letter or phoning clients. In this scenario, we also need to develop tasks that focus on technology and digital skills (pedagogic technology tasks). For example, learners may need to be able to work with a variety of email programs, digitally sign and attach documents, and manipulate pdf files. In this scenario, it is important to acknowledge the non-neutrality of technology and the impact that technological affordances, which includes how these affordances relate to the needs and capabilities of users (Blin, 2016), may have on the nature and appropriateness of a specific technology for a given technology-mediated task. In a TMTBLT approach, then, researchers need to focus on the specific affordances of a technological tool and the environment it inhabits and specific tasks or task types that promote language learning, as well as how these elements interact. In the sections that follow, we will discuss each of these in turn and suggest avenues of research that can increase our understanding of TMTBLT.

1.2 Affordances of the technology

We would like to emphasize the dangers of technological determinism, which refers to the idea that the introduction of a new technology automatically brings certain results (Warschauer, 2004). Not all technologies are equal. They come with specific shapes and expectations, which means that some technologies are good for accomplishing some tasks while not so good for other tasks. A piece of software or app often conveys or is at least consistent with, a certain teaching approach, which actively shapes what the teacher and/or user can do with it. In addition, there is often an assumption that technologies are passive tools completely subject to the user. This is far from the truth as technological objects can serve as active social actors, just as human beings do (Latour, 1996). Similarly, technology is often viewed as being free of pedagogical or philosophical bias. In fact, technologies are inherently biased because they are designed to accomplish certain very specific goals (Bromley, 1998).

Keeping the non-neutrality of technology in mind, it is essential that a language learning technology's design, implementation, and evaluation be guided by curricular principles based on education research into instructed second language acquisition (SLA) (González-Lloret, 2017). Motivation and novelty, while helpful to the process, are not sufficient to make new technological tools effective for language learning and the unanalyzed implementation of technology for L2 learning, is unlikely to result in improved learner outcomes and may lead to poor results, decreasing student satisfaction, and increased frustration levels, as the curriculum veers off-track.

1.3 Taxonomy of technological affordances

Focusing on computer-mediated communication (CMC) technologies, Smith, Alvarez-Torres, and Zhao (2003) argue that teachers and researchers need to consider how these technologies vary across four fundamental domains: temporality (synchronous vs. asynchronous), identity/anonymity, modality

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(oral vs. written), and spatiality. Fifteen years hence, these domains, while still important, are populated with an entirely new set of fast-changing technologies, which allow for new and exciting types of interactions. For example, the first iPhone appeared in 2007, which launched a mobile revolution. Modes of communication that once required a desktop setup are now available via mobile apps. Indeed, just as presence, which involves spatial and temporal dimensions, functions differently in face-to-face and online communication, the rapid rise of mobile applications allows us to use, say, Skype (launched in 2003) in many different ways in mobile environments than is possible in desktop versions. The types of tasks one can imagine developing using the mobile app are much more dynamic and potentially more interactive and authentic. This results in a necessary shift in how we view the concept of spatial distance, its embedded affordances, and how linguistic behavior may be influenced by how spatial distance manifests across technologies. Likewise, when considering technological affordances in the domain of temporality, one must consider the impact on the discourse and behavior of the interactants brought about by the amount of time a message takes to reach its audience. This is especially true as the lines between asynchronous and synchronous types of CMC are blurring.

In order to progress, the field of CALL needs well-developed arguments about the choice of one technology over another in addressing current research questions. We call for more explicit use of, and reference to, existing classification taxonomies in TMTBLT research. Practical issues, the existing cultures of use, as well as access to the technology surely play a major role in these choices; however, as a field, we can make a more persuasive case if there is a thoughtful and principled set of decisions that lead to the choice and justification of one technology over another in answering our research questions. For example, in focus on form tasks, why should we expect a PARTICULAR TECHNOLOGY to facilitate attention to form in the proposed environment? Such discussions are all but missing in current research.

Research task 1

Objective: Identify technologies that fit various common and specific instructional contexts and which are consistent with the research in instructed SLA.

Task: Evaluate a technological tool (WeChat) that, based on the tool's affordances, is likely to promote attention to linguistic form while completing a technology-mediated task.

This investigation explores whether learner focus on form (FonF) varies as a function of the modalities employed in WeChat. We choose attention to form in this example as this is a key construct in the interactionist approach to instructed SLA, a theoretical perspective that informs much of the TBLT research. However, constructs from other theoretical perspectives (such as learner agency from sociocultural theory) can be investigated as well. Likewise, the choice of programs, tools, and apps are so numerous and ever-changing that suggesting only one to evaluate for this task is admittedly limited. Nevertheless, we will use a specific tool below (WeChat) for illustrative purposes.

WeChat is China's most popular messaging app with a monthly user base of more than 1 billion people. It is similar in many ways to WhatsApp but includes many features found in other popular platforms such as Facebook and Instagram. It has a built-in QR code reader, it is typically linked to a bank account to make payments, and learner interaction is easily logged. With Chinese learners of English, WeChat would be a preferred mobile app for TMTBLT activities and therefore appropriate for the context.

To determine the degree of FonF afforded by WeChat, participants would engage in the task of finding an apartment to live together. After demonstrating to students the different features of WeChat, the pairs would have a week to find apartments for rent, share pictures, post comments, and engage in at least two text-based and two video-based chats. The data from the learners' interaction would be analyzed for instances of language related episodes (LREs) in which learners 'talk about the language they are producing, question their language use, or correct themselves or others' (Swain & Lapkin, 1998, p. 326) to discover which aspect of WeChat promotes more attention to language form and, therefore, determine the app's facility for leading students to focus on form in a TMTBLT context.

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2. Teaching and learning contexts: Goals, resources, and effectiveness

Being able to classify specific affordances of technologies for language learning is important because when a technology inevitably changes or is supplanted by something new, we can revisit in a principled manner whether the technology's affordances are still intact and functioning in the intended way (González-Lloret & Ortega, 2014; Chun, Kern, & Smith, 2016). In addition to the specific affordance domains outlined in Smith et al. (2003), Chun et al. (2016) propose a 'capacious view of technology' that considers broad principles surrounding technology and language use, language teaching, and language learning. This view requires an acknowledgment that our learners engage with digital technologies in ways that are often more varied and sophisticated than those they encounter at school (Jenkins, Purushotma, Weigel, Clinton, & Robison, 2009). This complicates the question of how teachers should approach the incorporation of technology in their teaching and is especially salient in TMTBLT environments since the entire task is interwoven with the technology.

Chun et al. (2016) argue that we must define and think about technology in broad, rather than narrow terms to increase the shelf-life and relevance of CALL scholarship. To this end, they offer a set of (typically unaddressed) heuristic questions, designed to help guide language teachers and researchers as they incorporate technology into their teaching and/or research agenda and evaluate its effectiveness. The first guiding question is *What learning goals do I have for my students?* This refers not only to the broad goal of being able to use the target language for communication and meaning-making, but also the need to understand the new types of discourses, social practices, and skills required to make use of and critically evaluate new and constantly emerging technologies. The next question, *What language, culture, and instructional resources do I have available*? focuses on the different mediums and instructional resources available and how they influence the way we design communicative tasks. The third question explores *how these resources can be used and combined most effectively to serve the established learning goals*, which aligns perfectly with the need to equitably balance attention to pedagogical language and pedagogical technology tasks in the TMTBLT framework. Finally, determining *how one can and should assess the appropriateness of specific language learning resources and the effectiveness of students' use of them* necessarily takes into account the affordances of employed technologies, learner (and teacher) experiences and expectations, and the language learning environment in which the learners find themselves, such as high/low resource or high/low access dichotomies (Healey et al., 2008).

Clearly, one must understand the affordances of a technology before one can rationalize its use for specific language learning goals. But as Hubbard (2011) points out, we must also consider a technology's 'fit' with the instructional context, which includes both teachers and learners. 'Teacher fit' refers to the degree to which a technology is compatible with the teacher's beliefs about language learning. 'Learner fit' considers the compatibility of the proposed courseware or technology with learner variables, such as age, native language, proficiency level, as well as learner needs and learner interests – and the syllabus, which describes the learning objectives and paths to achieve them. This notion of 'fit' is also consistent with Thorne's (2003) 'cultures of use,' which refers to the way learners currently select and employ digital devices and apps for personal and social purposes.

Research Task 2

Objective: Select the technology for your task-based CALL study in terms of the specific teaching and learning context in which it will be implemented.

Task: Investigate whether phone texting in an L2 is a useful tool to bring into your L2 for Tourism Purposes course.

To determine whether the L2 learners in your L2 for Tourism Purposes course can benefit from learning to text in the L2, we would first have to find out whether texting is the appropriate tool to use when conducting business in the tourism sector, such as when conducting and organizing meetings among hotel employees. To do this, as part of our needs analysis, we would ask several hotel

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managers (in the context of the L2) what tools they employ to communicate with their employees. If we confirm that texting is regularly used, we then develop the rest of our needs analysis: finding out what language is needed to accomplish the task by gathering a collection of such texts, for example. We would also need to know whether our learners have access to the technology (i.e., whether they own cell phones and data service) and/or what their digital literacy regarding texting is (e.g. do they know how to send pictures, respond to a specific message, create a group, text to a group, forward a text). Also, considering that most of our participants are likely to be multilinguals, we would want to find out whether translanguaging practices are acceptable in such a setting and whether and how learners use a multiplicity of resources (emoticons, media) including translanguaging. Finally, we would want to know what the sociopragmatic norms of the context are regarding texting.

We believe this acknowledgment of a multilingual world is an essential part of any TMTBLT research (and teaching); one that needs to be explicitly addressed in the background and methodology sections. As we have suggested before, not all tools are equal, and they are not equally suitable for all contexts. It is quite obvious that in a context with stable, strong, speedy, and reliable Internet, three or four students can work collaboratively using a multimodal platform that incorporates video, chat, and whiteboard features. However, this will be impossible in some rural contexts with less-than-optimal Internet connectivity. In this case, the task may still be accomplished using asynchronous tools (email) or collaborative writing tools such as Google Docs used asynchronously. Although the task can be very similar, the nature of the interaction will be very different and this needs to be reflected in the research design and data collection. Knowledge of the context is essential to understanding participants' level of access to technology, their digital literacies, and technical support available to them. It is important to consider these aspects when developing tasks, conducting research and/or using technology for L2 learning because first, the activity may fail without understanding the context, but also because as socially responsible researchers we want to employ technologies that 'bring about personal, financial, and symbolic benefits, so-called capital enhancing' (Ortega, 2017, p. 301).

3. Tasks in TMTBLT

Technologies for language learning need to be based on theoretically grounded research and also take into account the context of teaching and learning. This idea must be supplemented with research on how affordances of these technologies interact with tasks and activities in a way that maximizes the benefit of transformative new technologies. That is to say, there must be a principled way for teachers to develop and sequence technology-mediated tasks that elicit the intended type of learner behavior and language use as well as sufficient linguistic growth, given the resources and access available. In TBLT, task sequencing is directly tied to the notion of task complexity. Accordingly, another area in need of intense research is how the introduction of technology affects a task's complexity and even problematizes the very notion of task complexity.

3.1 Task complexity

Doughty and Long (2003) argue for the development of a series of pedagogic tasks sequenced in terms of 'inherent, unchanging, and objectively measurable task complexity,' with task difficulty modifiable as needed by changes to task conditions (p. 57). These suggestions are based largely on two models of task complexity: Skehan's Trade-Off Hypothesis (Skehan, 1998, 2009; Skehan & Foster, 2001) and Robinson's Cognition Hypothesis (2001, 2005, and elsewhere). In both models, what is of special interest to TBLT researchers is the way changes in cognitive task complexity draw the L2 learner's attention toward language and consequently influence task performance.

3.1.1 Skehan's Trade-Off Hypothesis

Skehan's original Trade-Off Hypothesis (Skehan, 1998, 2009; Skehan & Foster, 2001) assumes that attentional capacity and working memory are limited and argues that increasing task complexity

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will lead to competition between accuracy, complexity, and fluency. Skehan states that an increase in cognitive task demands puts pressure on the attentional system. Accordingly, L2 learners have to prioritize either linguistic complexity, or accuracy, or fluency. Committing attentional resources to one area might cause a lower performance in others. As tasks become more demanding, there are trade-off effects between form on the one hand and fluency and meaning, on the other. Tasks eliciting more linguistically complex speech decrease the accuracy of the learner's performance and vice versa.

Skehan (2009) argues that the three general measures of performance, complexity, accuracy, and fluency, need to be supplemented by measures of lexical performance either as a separate area or one folded into complexity, which would arguably contain structural and lexical complexity. He also points out that the construct of fluency needs to be reconsidered and viewed in a more subtle and deeper way. For example, rather than considering only the occurrence of pauses in determining (dis)fluency, he argues that we need to examine WHERE the pauses occur in the discourse. When examining the effects of planning time on fluency, for instance, non-native speakers are found to make many more mid-sentence pauses (as opposed to those occurring at the end of clauses, which is where native speakers tend to pause), arguably because they are unable to handle unexpected lexical choices. Much of the communication in TMTBLT will be in the written modality, so it is not clear how these new explanations of, say, simultaneous increases in complexity and accuracy will apply, given the quite different affordances of CMC. Indeed, there is evidence (Payne & Whitney, 2002) that suggests that the synchronous written CMC learning environment can reduce the burden on working memory and thereby produce a facilitating effect, arguably in terms of increased accuracy and complexity, for learners with a lower working memory capacity.

3.1.2 Robinson's Cognition Hypothesis

Robinson's Cognition Hypothesis (2001, 2005, and elsewhere) views working memory/attention as consisting of multiple resource pools. A task's complexity may make demands on one or more of these resources, but as long as these task demands do not draw upon the same resources, language performance will not suffer. Increasing particular task demands can focus attention and lead to more control of (speech) production. Performance problems stem from interference due to loss of control over attention. According to Robinson, increasing the cognitive demands along resource-directing factors draws the learner's attention toward the language code. When L2 learners try to meet the cognitive demands of a complex task, they use more elaborate and varied lexis and produce more complex linguistic structures (as well as more accurate production) but their production will be less fluent when compared to simpler versions of the task. Resource-directing variables include (1) whether the task requires reference to events happening now, in a mutually shared context (here-and-now), or to events that occurred in the past, elsewhere (there-and-then); (2) reference to few, easily distinguished elements, versus many similar ones; (3) reference to spatial location, where easily identifiable and mutually known landmarks can be used, versus reference to location without this support; (4) simple information transmission, versus reasoning about causal events and relationships between them; (5) simple information transmission, versus reasoning about other people's intentions, beliefs and desires, and relationships between them; and (6) and whether the task requires the speaker/listener to take just one first-person perspective on an event or multiple second- and third-person perspectives. In contrast, increasing the demands on resource-dispersing variables has a contrary effect on production. A higher cognitive task complexity on this kind of factor may lead to trade-off effects between linguistic complexity and accuracy, eliciting less accurate, complex, and fluent production when compared to simpler versions of the task. For example, not providing planning time or lack of prior knowledge disperses the task performer's attention away from the linguistic code and their production suffers.

The research agenda testing these hypotheses is one of the most active ones in TBLT, with research that often has yielded mixed results (e.g., Tavakoli & Foster, 2008; Sasayama, 2016). Though there is no research that is known to us that explicitly applies Skehan's Trade-off Hypothesis to computer-mediated settings, the CALL research examining Robinson's model suggests that the Cognition Hypothesis may not transfer easily to technology-mediated tasks and environments (Nik, 2010;

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Nik, Adams, & Newton, 2012; Baralt, 2013; Collentine, 2013; Adams & Nik, 2014). Accordingly, our discussion below will focus mostly on the Cognition Hypothesis as that is the framework that most TMTBLT studies have employed. We recognize, however, that more independent research is needed employing Skehan's framework in CALL settings. We also acknowledge that the field is still in search of conclusive findings regarding the validity of either task complexity framework.

3.2 Measures of task complexity in technology-mediated contexts

As stated already, the exact combination of task features that raise a task's complexity is still unclear and what constitutes increased task complexity in a technologically enhanced context is essentially unexplored.

In a face-to-face study, Révész, Michel, and Gilabert (2016) attempted to provide independent evidence that tasks that were designed to be more complex did, in fact, place greater cognitive demands on participants. In this study, they explored three methods that could be used to establish the validity of cognitive task complexity manipulations – dual-task methodology, subjective self-ratings, and expert judgments of task difficulty, across three task types – a narrative, a map, and a decision-making task. They found that for all three task types, native and non-native speakers achieved lower accuracy rates on the secondary task (in the dual-task method, which can be considered an objective measure) when carrying out the complex versions of the primary task. Likewise, both native and non-native speakers perceived the high-complexity version of the tasks as more cognitively demanding and, for the most part, more difficult. Finally, the experts judged the high-complexity tasks to demand more mental effort and to be more difficult. These latter two measures may be considered subjective in nature. Révész et al. (2016) argue that the convergence of all three measures suggests that the more subjective measures of task difficulty may serve as valid surrogates for the more difficult-to-administer objective measure. They further acknowledge the limitation of incorporating only one objective measure in their design and call for future research to incorporate additional objective measures (eye-tracking, neuroimaging, etc.). Finally, they call for additional and perhaps more authentic tasks – especially secondary tasks.

Research task 3

Objective: Investigate whether research with technology-mediated tasks confirms results from similar face-to-face studies that suggest that more subjective measures of task complexity are sufficient.

Task: Replicate Révész et al.'s (2016) study regarding the usefulness of dual-task methodology, self-ratings, and expert judgments in assessing task-generated cognitive demands as a way to provide validity evidence for manipulations of task complexity.

Replicating the results above in a video-based context, using the same three task types – a narrative, a map, and a decision-making task, would test Révész et al.'s claims regarding the necessity for more objective measures of task complexity in favor of more subjective, but equally effective measures. This would (perhaps) make it easier to compare findings across future studies because of the decreased number of measures being employed. Follow-up studies could then begin exploring the relationship between student (self) and teacher (expert) judgments of task difficulty and the resultant degree of linguistic accuracy. The expected inverse correlation between complexity and accuracy would remain the same, at least for TMTBLT in the oral/aural modality. One step further for TMTBLT would be to investigate whether the relationship would hold up in a synchronous written TMTBLT environment such as a chat or text messaging.

With such a conceptual replication (Porte, 2012), TMTBLT researchers could answer the call for the incorporation of additional objective measures as well as a higher level of task authenticity in a single study. For example, they could employ multiple and highly authentic technology-mediated dual-methodology tasks. This could be achieved by first conducting a needs analysis for the specific target

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group of learners from which a large but finite number of real-world technology-mediated tasks would emerge. Next, researchers could incorporate additional objective measures of task difficulty. Whereas eye-tracking and neuroimaging are certainly options, more palatable to a TMTBLT approach – especially if conducted in a mobile language learning environment – would be capturing other types of process data available, by using screen capture or other logging techniques. In this way researchers could examine instances of, say, self-correction while navigating a task, seeking online help of some sort while completing the tasks, etc., both of which are invisible when examining outcomes alone. Such data would inform the calculation of a task's difficulty. Finally, researchers could employ introspective or retrospective techniques to better understand which task features led to more/less mental effort on the part of participants. The other more subjective measures used in Révész et al. (2016) could remain the same and a similar comparison to the original objective measures could be made.

3.2.1 Task complexity of technology-mediated tasks

The few CALL studies that have explored Robinson's Cognition Hypothesis yield results that question the validity of simply applying his framework directly to text-based synchronous computer-mediated communication (SCMC) environments. In a series of studies, Adams and Nik explored the effects of manipulating resource-dispersing elements in text-based CMC tasks on learners' written production (Nik, 2010; Nik et al., 2012; Adams & Nik, 2014; Adams, Nik, & Newton, 2015). For resource-dispersing dimensions of cognitive task complexity, Robinson (2005) predicts that any increases should result in (1) decreases of complexity, accuracy, and fluency in both monologic and interactive contexts and (2) increases in the amount of negotiation in interactive contexts. Results in Nik et al. (2012) showed that, opposite to the predictions of the Cognition Hypothesis, increasing task complexity (by decreasing task structure) led to a reduction of interactional modifications. On the other hand, Nik (2010) found more accurate language produced by students performing a task with more structure (a less complex version of the task), but with no significant effects on the complexity or quantity of language production. In terms of prior knowledge, Adams and Nik (2014) found that performing a task without prior knowledge (with greater cognitive complexity) resulted in more global accuracy, more lexical complexity, and fewer negotiations. All three findings run counter to the predictions of the Cognition Hypothesis. Adams and colleagues attribute the differing pattern of findings to unique characteristics of text-based CMC (Adams & Nik, 2014). Written language production occurring in CMC may change the nature of the cognitive load on L2 production assumed in the Cognition Hypothesis, which was developed based on psycholinguistic models of oral production, not CMC. In addition, the increase in online planning time afforded by the CMC medium allows for greater opportunities to process one's own output while composing and editing text prior to sending messages.

Other examples of investigations of complexity in TMTBLT are Baralt (2013) and Collentine (2013). Within Robinson's framework, Baralt (2013) investigated the resource-directing variable reasoning demands. In her study, she explored how cognitive complexity in face-to-face versus CMC environments mediates the efficacy of recasts in promoting L2 development. Reasoning was made more or less demanding by providing or withholding story characters' intentional reasons in the materials for several story-retelling tasks that involved familiar ethical dilemmas. Baralt found that her face-to-face learners behaved as predicted by the Cognition Hypothesis in terms of learning (more complex tasks resulted in more complexity, accuracy, and fluency) but the CMC learners experienced more learning in the cognitively simple condition. In addition, the learners in the face-to-face group perceived the task as more difficult than those in the CMC groups. Collentine (2013) investigated 60 third-year university Spanish students engaged in a 3D world with two information gap tasks (a missing-persons and a crime-solving task), followed by an SCMC chat in pairs to share the gathered information to solve the case. The input the learners received included 41 statements in 2 parallel versions of differing low and high linguistic complexity. For example, a student could ask the avatar 'Who did you dance with?', and the pop-up text answer would be either a simple version 'With Nora. She lives over there. She danced a lot… And very well') or a complex version ('Well I danced with Nora. I think that Nora lives in the house over there; she danced a

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lot and she dances well') (Collentine, 2013, p. 51). Via user-tracking data methods, Collentine mapped the learners' movement and the language input that they received and analyzed the language produced during the CMC discussion. The results suggested that learners were able to produce more complex language and included more information when the input they received included non-complex structures, which also suggests that the Cognition Hypothesis does not transfer to this type of technology-mediated task.

Research task 4

Objective: Investigate whether different technologies affect the complexity of a task in the same manner.

Task: Replicate Adams and Nik (2014) using three different CMC modes: text-based, audio-based, and video-based.

One of the ways to explore whether differing technologies is a factor affecting complexity could be to replicate Adams and Nik (2014), but incorporating different technologies. Adams and Nik (2014) used interactive problem-solving tasks familiar to the students (chemical and electrical engineer students). Each learner was required to use chat (text-based CMC) to role-play an engineer in a multinational company meeting online to decide on an electrical engineering software for the company to adopt. For the electrical engineering students this was a + prior knowledge condition, while it was a – prior knowledge for the chemical engineering students. In addition to the chat transcripts, the researchers also conducted interviews with the students. The replication study would collect data from two additional groups engaged in the same task, with the same two conditions but using a video-based tool such as Skype, Google Hangouts, Facetime, or Zoom. Since one of the conclusions of Adams and Nik (2014) was that text CMC may allow more time for output processing, using audio and/or video CMC would require more online oral production reducing the possibilities for planning. The results would allow us to see with more clarity whether the technology is a factor affecting complexity and whether the predictions of the Cognition Hypothesis would hold true. In addition, since we argue that the degree to which tasks vary along the dimension of task complexity is influenced by the type of technology employed (e.g., mobile vs. desktop; video-enhanced vs. audio-only or text-based), video and audio-enhanced mobile interactions among learners may introduce a new dimension of 'complexity' that is different from that found in text-based CMC or even face-to-face interactions. Such a technological overlay will almost certainly yield a different level of complexity from that found in similar tasks in non-technology-enhanced settings. The research in this area is wide open.

The research described in the previous section suggests that the Cognition Hypothesis may not transfer very well to technology-mediated tasks and environments. We call for more research of this sort that tests the other factors argued to influence task complexity. Up to now only the resource-directing factor INTENTIONAL REASONING and resource-dispersing factors TASK STRUCTURE and PRIOR KNOWLEDGE have been explored. For example, there is no TMTBLT research that examines task complexity across the resource-directing factors ± here and now, few elements, spatial reasoning, causal reasoning, perspective-taking – nor is there any that explores the effects of manipulating the resource-dispersing variables of ± planning time, single task, few steps, independency of steps. To truly test the viability of this model in a TMTBLT environment, most if not all of these variables should be explored empirically.

What constitutes cognitive task complexity online and how it may affect learning is not at all well understood. Most studies testing (and often supporting) the Cognition Hypothesis to date have focused on exploring task complexity along the resource-directing and resource-dispersing variables; however, Robinson's framework also includes interactive factors (task conditions) resulting from the interactional demands of the task such as the number of participants, convergent/divergent task goals, as well as learner variables such as motivation and aptitude (task difficulty). We know very little of how these other variables affect task performance and what influence they may have on language learning and next to nothing about their impact in a TMTBLT environment. Accordingly,

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González-Lloret and Ortega (2018) suggest that including interactive factors (task condition) and learner factors (task difficulty) in explorations of Robinson's model is essential – especially in research into technology-mediated environments. They propose an expanded model based on Robinson's that includes sociopragmatic interactional variables and considers the importance that artifacts and environmental mediation (Marsh & Onof, 2008), especially technologies, have on the task.

Studies including some of these other factors exist in the general CALL literature, but not within the TMTBLT framework. Multiple studies have investigated affective variables (task difficulty) such as motivation, anxiety, and confidence (e.g., Ushioda, 2013; Reinders & Wattana, 2015), aptitude (e.g., Mekheimer, 2012) as well as the interactional factors of the task (e.g., Granena, 2016) and participant variables (e.g., Belz, 2002). However, we do not have a clear picture of how these factors interact with each other and how they affect the task and ultimately language learning.

Research task 5

Objective: Explore how other factors included in the triad of task factors proposed by Robinson (2005) (task conditions and task difficulty) interact with task complexity.

Task: Compare learner language production on a monologic task with that on an interactive task for a variety of modes: face-to-face, text-mediated CMC, video CMC, and in a synthetic environment to determine how interactivity and learner factors interact with one another as well as with the modality employed.

In this study, learner internal variables, such as working memory capacity and willingness to communicate would be measured (see Mekheimer, 2012 for aptitude and Reinders & Wattana, 2015 for willingness to communicate). Participants in the study would then be randomly placed in one of eight groups: face-to-face monologic task, face-to-face interactive task, text-mediated CMC monologic, text-mediated CMC interactive, video CMC monologic, video CMC interactive, synthetic environment monologic, and synthetic environment interactive. The eight groups would then be compared on several measures such as language complexity, fluency, accuracy, and adequacy (Kuiken & Vedder, 2017). As with the previous research, it is also important to include several independent measures from cognitive psychology, to make sure that the two different tasks are actually different.

3.4 Task sequencing

Task sequencing is essential within the TBLT framework and we believe that more research is needed that specifically examines how tasks can be sequenced based on the notion of cognitive task complexity in online environments. Such research will further our understanding of the pedagogical potential of tasks for L2 learning and will afford teachers and curriculum designers guidelines for designing and sequencing tasks in online environments. Such work may also have implications for how we think about task complexity in traditional environments and its position in SLA theory more broadly.

In this line of research, Baralt (2014) explored four sequences of tasks to test Robinson's (2011) claim that tasks should be ordered in the curriculum by gradually increasing their cognitive complexity over time. In dyads, students completed three story-retelling tasks in four different task sequences manipulated to differ in reasoning demands (simple-simple-complex; complex-complex-simple, complex-simple-complex; and simple-complex-simple). For the face-to-face condition, task sequences that incorporated more of the complex task version (simple-complex-complex and complex-simple-complex) generated the most LREs[1] and produced more targeted linguistic items (past subjunctive) in agreement with Robinson (2011). However, Baralt found no LREs at all during the technology-mediated task interactions and no use of target structure on the oral or written post-tests, regardless of task sequence order or complexity.

[1]Tavakoli and Foster (1998) defined LREs as any part of the dialogue where learners talk about the language they are producing/produced, question or reflect on their language use, or correct themselves or others.

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Research task 6

Objective: Replicate Baralt's (2014) study capturing more learner process data through screen capture and eye-tracking technology.

Task: Conduct a replication of Baralt's (2014) study comparing four task sequencing conditions in face-to-face and technology-mediated conditions.

Given the perplexing results of Baralt's study, it would be interesting to replicate it capturing more learner process data through screen capture and eye-tracking of the students engaged in the technology-mediated CMC task as well as video recordings of the face-to-face groups. In addition, retrospective methods (such as stimulated-recall interviews) could be conducted to tease out the reason(s) for such discrepancies in terms of LREs. Also, as suggested by previous research on text-based CMC (by Adams and colleagues), these two modes may involve different cognitive processes and, thus, may not be comparable. Therefore, including another group that would perform the same task sequences in audio or video CMC (or a synthetic environment orally through an avatar), which is more similar to oral interaction, may be a useful addition to the study.

We believe that technology can also aid in the research on task complexity and task sequencing. In the first study of task complexity employing eye-tracking, Révész, Sachs, and Hama (2014) used eye-tracking as an independent measure of cognitive load. Eye-tracking helped confirm that the designed-to-be-complex task was actually more complex since the number of fixations was higher and the fixations were longer. In this way, the authors were able to establish that their manipulation of the task complexity produced different levels of cognitive demands. This is extremely important since only with these independent measures can we ensure that what we call more complex is actually cognitively different from a less complex variable (see Sasayama (2016) for more on this argument).

4. Mobile-based tasks and technology-mediated technologies

The gap between smartphone use and PC/laptop use continues to widen, with smartphones being the clear winner. In the United States, the number of people that own a smartphone has increased from 35% in 2011 to 81% in 2019, and smartphone use to navigate the Internet has increased across all age groups (Anderson, 2019). The use of smartphones (versus other technologies) is even more prevalent in emerging economies (Silver et al., 2019). This, coupled with the surge in interest in place-based learning and TBLT, requires that we explore the nature of mobile-assisted language learning (MALL) within a TMTBLT framework. Indeed, our call above for more work on the specific affordances of new technologies is perhaps most needed in MALL environments.

Much of the theoretical basis for employing SCMC in L2 teaching and learning is grounded in 'first generation' CMC research findings from the late 1990s and early 2000s. For example, SCMC has been shown to elicit a higher quality and quantity of L2 output among learners engaged in online interaction. SCMC is also argued to enhance the likelihood that learners will attend to (and arguably better learn) formal aspects of the target language as the medium affords learners more processing time and the message permanence on the screen allows learners to revisit an interlocutors' input. However, whether these findings carry over to a MALL setting is largely untested. Such TMTBLT research employing smartphones (rather than desktops) is surely more ecologically valid today as these devices are dwarfing sales of desktops and laptops, and mobile apps such as Snapchat, Instagram, FaceTime, WhatsApp, and WeChat dominate daily communicative interaction among young people. In fact, about 95% of teens in the U.S. own a mobile device and teens now report texting rather than talking as their favorite way of communicating with friends (Common Sense Media, 2019). Given the clear differences in desktop-based SCMC and that conducted on mobile devices (screen size, spatiality, mobility, etc.), we need to confirm that the SCMC findings from the early 2000s are valid in

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MALL contexts. Virtually any of the relevant work into task-based learner interaction (either face-to-face or computer-mediated) can and should be replicated in a mobile context.

Research task 7

Objective: Explore how the affordances of emerging and ubiquitous new(er) technologies impact the nature of task-based learner interaction and translanguaging.

Task: Investigate the potential of several desktop- and smartphone-based communication tools for language, culture, and identity exploration and learning.

As more learners use their phones to connect to others and conduct their daily business (Anderson, 2019), teletandem projects (where two groups of students connect to learn/practice one anothers' languages and cultures) are being affected by the platform students use. It is therefore important to know what effect, if any, the use of mobile phones has on student interaction and language development when engaged in teletandem tasks.

For this study, a group of students engaged in teletandem would use two different platforms to conduct their tandem interactions. Half of the students would use desktop or laptop computer-mediated interaction through their choice from a variety of tools such as Skype, Hangouts, Google Meet, while the others would engage via mobile phone using the same app. Halfway into the project the groups would switch tools. During the teletandem, students would be encouraged to use all their multilingual resources to explore issues of identity, culture, race, and global connection through a series of discussion tasks. At the end of the project, learners would be surveyed (and/or interviewed) on their preference of tool, ease of access, connectivity, and perceived amount of interaction, as well as their view on the potential of the tools to facilitate translanguaging and the exploration of their identity. Data would also be collected to investigate their amount of interaction, time on task, ease of access, etc. Their recordings, as well as any artifacts that they exchanged, would also be analyzed for instances of development of intercultural competence (Byram, 1997) and performance of language and identity (Creese & Blackledge, 2015). The results of the data comparing the groups would give us a first look at how mobile phone task interaction compares to traditional computer-mediated interaction. The data would also help us understand better how different tools may help learners use their multilingual resources to connect with others and what role translanguaging may have in teletandem projects.

Research on mobile-mediated tasks will require detailed logging of learner online behavior, which may get very complicated since our mobile interactions are typically multimodal in nature, containing text, audio, video, and images. Additionally, researchers require learner output in usable formats for analysis, for example, when using WeChat for TMTBLT task, one would have to use third-party software to capture a searchable database (rather than collecting a series of screenshots) of learners' interactions. Nevertheless, despite the methodological challenges such work poses, given the shift to mobile interaction in our daily lives, such research must be tackled. As technology evolves, some of these constraints will disappear, making research on this area more effective and reliable.

4.1 Social media

There have been several CALL studies that explore the potential of using social media tools for language learning and literacy. Although teens have been abandoning the most popular social media tool (Facebook) in favor of YouTube, Instagram, Snapchat and TikTok, studies using Facebook to investigate aspects of language learning and use still thrive. One example of such a study is Wang and Vásquez (2014), who asked whether there was any difference in the quantity and quality of the written texts produced by two groups of intermediate-level Chinese language learners over the course of one semester. One group wrote weekly updates and comments in Chinese on a designated Facebook group page, while students in the control group did not post on the Facebook page (but received the

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same instruction and assignments). There were mixed results in terms of the quantity of writing produced by the experimental (Facebook) group, with this group writing significantly more than the control group in two of three writing tasks. However, no differences were found in terms of quality. The authors argue that the results suggest that Facebook can be used as an alternative pedagogical space for L2 literacy practice outside of class, with the potential for helping L2 learners improve at least some aspects of their writing performance. Also using Facebook, Schreiber (2015) studied the multilingual writing practices of a Serbian student using different varieties of English and Serbian and a variety of multimedia to construct his online identity within several communities. The results show a high degree of linguistic creativity and the use of other semiotic resources through which he constructed an image of himself as firmly grounded in his local identity while a member of a global community. The participant's translanguaging attitude was a reflection of his understanding of the communities as composed of other multilinguals and the role played by technology in facilitating his translanguaging practices.

Research task 8

Objective: Investigate learner use of social media sites in a way that reflects the main tenets of TMTBLT.

Task: Examine the impact of using well-designed task-based social media tasks on subsequent quantity and quality of learner L2 writing.

The proposed study would use Wang and Vásquez (2014) as a starting point but would make the following changes to their design. Most important is to allow learners to self-select into groups that have a shared interest. This might be hiking, mountain biking, horror films, guinea pigs, home brewing, etc. Next, the learners in each interest group will find a finite number of existing Facebook group pages that focus on their shared topic, agree to use one of these group pages and then all join that group. This is important as research has shown that learners are quick to reject any perceived artificial use of social media for instructional purposes (Reinhardt & Zander, 2011). Each group member could be instructed to post at least two queries/comments and simply comment (using text, not simply emojis) on at least four other posts each week. However, there should be some overarching goal to the learner engagement in their Facebook group, such as having to write an entry about the group's activity in a newsletter, etc. The writing tasks should be meaning-focused and spread across the semester. Each writing task should be specific enough to require learners to draw upon the Facebook group's activity over the past few weeks, yet general enough to allow the use of the same task prompt by each of the various interest groups, regardless of their topic. The experimental group (Facebook group) could be compared to non-Facebook group students who complete a similar amount of out-of-class interactive reading and writing activities and who take the same or similar writing tests. Ensuring the writing tests are parallel and comparable even though the prompts will be slightly different will be key. Whereas measuring the quantity of writing during the three tests is of some interest, more interesting will be the comparison of the qualitative differences that might emerge. Researchers could use standard measures of complexity, accuracy, lexical sophistication, and functional adequacy to determine qualitative differences. It would also be advisable to include post-treatment retrospective measures that may tap into any heightened degree of motivation and/or satisfaction that students report. Although this proposed study uses Facebook as the social media platform, one could easily retool the study above to work with Instagram, YouTube, Snapchat, Reddit, and Fan Fiction sites.

5. Process data

Building on the idea that we need to test existing frameworks guiding our choice of technology in TMTBLT, it is extremely important to employ research methods whereby teachers and researchers

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can capture and evaluate learner process data. That is to say, we must be cognizant of the fact that just because a technology offers certain possibilities does not necessarily mean that learners will make use of them. Capturing real-time learner data that vary across cognitive, affective, and learner factors is important if researchers are to determine the relationship between specific learner behaviors and outcome differences across tasks and task types. Our prediction of learner behavior based on the technology employed coupled with the nature of the task may suggest one set of outcomes, but learners may, in fact, behave differently from these predictions (Fischer, 2007). Also, learners are not consistently aware of what they do when engaged in technology-mediated tasks which calls into question the accuracy of their perceptions. For example, Smith (2009) found that the affordance of scrolling back to re-read earlier messages in text-based chat tasks was not borne out in actual learner behavior to the degree that one may have expected. Also during text chat, Smith (2008) showed that only by collecting process data could an accurate level of learner self-initiated self-repair be determined – a level far higher than the chat transcripts revealed.

Depending on the research questions posed, data can be collected through detailed logging of learner navigation (e.g., Fischer, 2007) and by screen capturing the entire online task (e.g., Smith, 2008). In most cases, such data need to be supplemented by more traditional introspective or retrospective techniques. In some instances, a more detailed account of learner behavior may be required, such as those exploring learner attention to form. In such cases, eye-tracking has been shown to provide interesting insights into what learners attend to during dyadic SCMC (Smith & Renaud, 2013; Michel & Smith, 2018). As with any other research decision, the tools and the data collected should be driven by the research questions and the researcher's capability for collection and analysis.

Research task 9

Objective: *Using learner process data, explore the role of technology-enhanced modality on learner syntactic complexity and/or accuracy.*

Task: *Using eye-tracking technology, investigate whether video-based tasks requiring more complex lexical choices by learners (for example in an L2 for academic purposes context) results in a 'derailing' of syntax (Skehan, 2009).*

This study would compare two modalities of SCMC (video and text) with modality as the independent variable. Learners in the video-enhanced condition would engage in spoken interaction with a peer, whereas those in the text-based setting would rely on synchronous text-based messages. The dependent variable would be the resultant syntactic complexity and or accuracy. Researchers would collect eye-tracking and screen capture process data for both modalities. Based on what we know about the nature of SCMC and drawing on SLA theory from the face-to-face literature, we may expect there to be more complex and or accurate syntactic constructions in the text-based condition despite the fact that the tasks placed similar cognitive demands on learners in terms of lexical sophistication. Because of the additional online processing time afforded by the written SCMC medium, the process data may very well show heightened attention to form in the written condition. For example, the eye-tracking data would help determine whether the learners actually make use of this additional time to attend to formal aspects of the input and their own output. Such process data could also be correlated with retrospective accounts of learner attention to form.

6. Conclusions

As we have suggested through these pages, the research agenda for TMTBLT is wide open, which is not surprising given that this field is in its infancy. Many issues are still to be resolved in the general fields of TBLT and CALL – more than we can bring up in this article. We believe the research agenda can expand in multiple and exciting directions, especially as technology changes and becomes more ubiquitous. However, it is essential to be able to aggregate findings into more robust results that

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allow us to state with confidence how tasks and technologies work and in which ways they intersect to promote language learning. Although the temptation to investigate the newest and shiniest new technology is hard to resist, we believe replication studies and investigation that closely and incrementally builds on the pillars of previous research is the best way to grow our knowledge. Also, as our world changes with and because of technology, we need to keep examining our theoretical frames of learning and adjusting them to how people actually learn languages in brick-and-mortar classrooms, online platforms, and in the physical world.

We would like to end by suggesting that all of the tasks proposed above should consider issues of multilingualism and social justice (Ortega, 2017). We recognize that the digital divide is real and that our responsibility as researchers and educators is to provide technological knowledge with an added value for social justice and personal gain for those that need it most. As one of our reviewers pointed out, TMTBLT could make language learning opportunities more accessible. We agree that the inclusion of technology-mediated tasks could have clear benefits for learners' futures. Technology-mediated tasks such as learning digital skills to find and secure a job online (from finding a job on appropriate sites to writing and submitting applications, developing a video resumé, and successfully navigating a video-based job interview) could have a positive impact on learners' lives.

Finally, with easier access to large quantities of data, data protection and safe and ethical data use become extremely important. Most higher education institutions in Western countries have regulations in place to manage these issues when conducting research, but it is also essential that we maintain high standards for the safe and ethical use of data in our daily teaching practice. Unfortunately, as research has shown, not all educators keep these concerns in mind when designing technology-mediated activities (Shin, 2015) so it is our responsibility as the CALL community to advocate for and ensure ethical use of data that promote digital literacy in equitable ways which are respectful of learners' educational and technological contexts.

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