A complex approach to technology-mediated task-based learning

Uma abordagem complexa para aprendizagem baseada em tarefas mediada por tecnologias

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Abstract: The focus of this study is the process of teaching/learning English as a second language in CALL, emphasizing oral interaction in an environment mediated by a synchronous communication tool using Task-Based Learning (TBL) under the perspective of the Complexity Theory. It aims to analyze and define the task cycle as a Complex Adaptive System. The current study adopts a netnographic methodology that deals with theory and practice adapting the ethnographic method to include the influence of the internet in technology-mediated environments. We built the dataset using video recordings of five classes carried out in an environment mediated by Zoom. The participants were students from the Biotechnology program at the Federal University of Pelotas selected due to their need to have online meetings with researchers from international universities. Based on a complex and netnographic perspective for data observation, it was possible to demonstrate that the task cycle, in this new learning environment, is sensitive to initial conditions, unpredictable, open, dynamic, adaptive, complex, chaotic, nonlinear, self-organizing, and sensitive to feedback. This study attempts to

contribute to developing a new area of investigation in CALL due to the need to understand better the pedagogical implications of the interactions in this unique learning context in a complex and non-reductionist manner using a robust theory as the Complexity Theory.

Keywords: Technology-Mediated Task Based Learning. Complexity Theory. CALL.

Resumo: O presente trabalho tem como objetivo analisar o processo de ensino/ aprendizagem da língua inglesa como segunda língua na área de CALL, com ênfase na interação oral em um ambiente mediado pela tecnologia síncrona de comunicação usando a Aprendizagem Baseada em Tarefas (ABT), sob a perspectiva da Teoria da Complexidade. Além disso, visa a analisar e definir o ciclo da tarefa como um Sistema Adaptativo Complexo. A metodologia deste estudo possui caráter netnográfico uma vez que esse modelo de fazer pesquisa permite lidar com questões relativas à teoria e à prática, adaptando a pesquisa etnográfica a fim de incluir a influência da internet nos ambientes mediados pela tecnologia. Os dados foram construídos usando as gravações de cinco aulas em um ambiente mediado pela ferramenta *Zoom* de comunicação síncrona. Os participantes eram alunos do curso de Biotecnologia da Universidade Federal de Pelotas e foram selecionados em razão da necessidade de realizarem reuniões com pesquisadores de universidades internacionais. Com base em uma perspectiva complexa e netnográfica para observação dos dados, foi possível constatar que o ciclo da tarefa neste novo ambiente de aprendizagem é sensível às condições iniciais, imprevisível, aberto, dinâmico, adaptativo, complexo, caótico, não-linear, auto-organizável e sensível ao *feedback*. Este estudo visa a contribuir para o desenvolvimento de uma nova área de investigação em CALL, devido à necessidade de se entender melhor as implicações pedagógicas das interações que acontecem dentro desse novo contexto de maneira complexa e não reducionista, baseando-se em uma teoria robusta, como é a da Complexidade.

Palavras-chave: Aprendizagem Baseada em Tarefas mediada por Tecnologias. Teoria da Complexidade. CALL.

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Introduction

The year is 2025. Picture yourself in a classroom of English as a second language (ESL). The teacher sets the scene for the task: Students need to pay for a basketball game ticket, which costs ten dollars, and they only have a twenty-dollar bill. The school secretary, who is collecting the money, does not have any change, so they need to pay with an exact ten-dollar bill. On the way to school, they pass by the neighborhood supermarket where they are regular clients and thought they would stand a chance to get the exact change.

At this point, the teacher instructs students to put their augmented reality (AR) headsets on, suddenly teleporting their eyes and ears to another location. They are now inside an avatar, in a virtual supermarket, and as they move in the real world, their avatars move in the virtual one. A man at the check-out turns to them and says: "Can I help you?". Students then need to interact with him and carry out the task in this new learning environment.

Which teaching approach are we going to use when this technology, which is already available for some video games, is also available to ESL classrooms? Will we choose an approach that views language as a linear system and teaches it in an established sequence? Or an approach that considers language as a nonlinear system and can adapt to this new learning environment?

In addition to answering the previous questions, the following research questions were formulated for the present study:

1) Is it possible to take Task-Based Learning (TBL) to an environment mediated by a synchronous communication tool, a technology widely available nowadays?
2) What are the positive and negative aspects of this transposition?
3) Is it possible to analyze the learning process of English as a second language (L2) with emphasis on oral interaction under the perspective of Complexity Theory (CT) in this new learning environment?
4) Is it possible to characterize the main stage of this approach – the task cycle – as a complex adaptive system (CAS) in this technology-mediated environment?
5) To what extent is TBL suitable to adapt to future technologies not available to the regular ESL classroom yet, such as AR?

Although integrating tasks and technology seems to have a positive impact on creating learning affordances, more research is needed to explore the potential benefits of this integration (ZIEGLER, 2016a). Despite the wide availability of synchronous communication tools such as Zoom and Google Meet, there has been relatively little research on how these new learning environments affect learners' language development (ZIEGLER, 2016a). In this context, we have tried to broaden current knowledge and practice of Technology-mediated Task-Based Learning under the Complexity Theory (CT) perspective. Although CT has contributed to and influenced our understanding of second language development, such an approach has not yet been widely adopted in CALL (SCHULZE, 2017).

In this article, following this introduction, we carry out a brief literature review approaching Task-Based Learning and Complexity Theory, the theoretical framework used in this study. Hereafter, we describe the study (methodology, context, participants, design,

communication tool, and data collection), followed by the findings and discussion to answer our research questions. Finally, remarks are made, and the paper is rounded off with a conclusion.

Task-Based Learning

According to Ellis (2003), ESL researchers, language teachers, and material designers were quick in recognizing the value of tasks. However, they do not seem to agree regarding the use of tasks in the language classroom. Some of them simply incorporate tasks into their traditional teaching approaches; others prefer to deal with tasks as teaching units and elaborate whole courses around them. These two ways of using tasks in the language classroom are classified respectively, as language teaching supported by tasks and language teaching based on tasks. In both cases, tasks are employed to bring more communication into the classroom, and as a result, they are essential features of communicative language teaching.

TBL is considered a strong approach to communicative language teaching (ELLIS, 2003) as it provides the basis for the linguistics curriculum. According to Ellis (2003), this strong approach to communicative teaching may be carried out in various ways, not only using tasks. Nevertheless, tasks are valuable affordances when planning a communicative curriculum, particularly in contexts where there are few opportunities to experience authentic communicative experiences, such as in the ESL classroom. Ellis (2003) highlights, as one of the positive points regarding an approach based on tasks, the ability to knock down barriers between what should be taught, and how it should be taught. Prabhu (1987) argues that the development of linguistic competence in an L2 does not require input systematization or to maximize a practice but to create conditions in which students join efforts to communicate. Prabhu believes students reach these learning affordances through performing tasks (PRABHU, 1987).

Kumaravadivelu (1993) claimed that "the methodology becomes the central tenet of task-based learning" since the goal is to allow learners to navigate their own paths and routes to learning. Therefore, we can establish a close relationship between this vital characteristic of TBL and complex systems, as such systems are unpredictable. During the task, seen as a complex system, it is unlikely to predict what the students will learn. Tasks also motivate students

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to recognize their feelings and share them with others, increasing their self–esteem and motivation to learn. Kumaravadivelu (2006) has also traced the main trends in TESOL methods. He stated that the change from communicative language teaching to task–based language teaching is one of the three perceptible shifts in the area (KUMARAVADIVELU, 2006).

TBL provides the opportunities for free and meaningful use of the target language and therefore fulfills the four conditions to learn a second language in accordance to Willis (1996): i) exposure to the target language; ii) use this language to do things; iii) motivation to use the target language; and iv) focus on linguistic forms.

Six theoretical propositions for Task–Based Learning

TBL offers an alternative to those learners who leave the classroom unable to communicate in the L2 they are learning. Research on second language acquisition (SLA) shows that people do not learn grammar step by step (WILLIS, 1996). Grammar is too complex and broad to be understood from an explanation followed by practicing pieces of the language. Alternatively, tasks allow students to focus on using language to create their own meanings, using words and expressions they might remember and, as a result, refine and build their language along the activity. When learners notice they can achieve the goals of the task, even with their limited knowledge of the target language, they gain confidence, feel free, and increase motivation. TBL provides students affordances to express what they really want to, focusing on developing their own language while they go through the task cycle[1], analyze and practice language forms. When deciding on using TBL in the language classroom, teachers and researchers should look for support in the six TBL theoretical propositions, based on Willis & Willis (2010). The following paragraphs aim to illustrate these propositions.

The first proposition states that language is a meaning system: When learning an L2, one learns a new system to express these meanings. Language is not developed in a vacuum. It develops in answer to a need for meaning–making. The second proposition is directly linked to Krashen's (1982) hypothesis, which states a difference between language

[1] The task cycle, the second phase in Task–Based Learning, comprehends three stages: task, planning and report.

learning and language acquisition[2]. However, this distinction seems to be imprecise and quite unclear. Such imprecision may be explained when we look at the language from a complex perspective and consider language a complex and permeable adaptive system made up of multiple agents interacting and making this system sensitive to external factors, responsive to feedback, and unpredictable but also dynamic. Due to this imprecision, this article prefers to use language development rather than learning or acquisition. One reason for this is that, according to Larsen-Freeman & Cameron (2008), complex systems reject a view of language as something that is taken in, that one acquires and therefore possesses.

The third proposition states that language development is prompted by the need and desire to communicate through meaning-making. The fourth proposition presents a multifunctional aspect of the language: It serves as a wide range of functions, including introducing oneself. This aspect is made clear when linguistic and usage varieties of the language are considered at an individual level.

The fifth proposition is closely related to the fourth: Language is variable. People vary language to meet different circumstances and different expectations. Directly or indirectly, we have proposed in this section that language is a meaning system, according to Willis & Willis (2010), and we would like to add to the author's definition that language is a *complex* meaning system. Although conscious processes may contribute to learning, language development is prompted by the desire to communicate; language and language use are intrinsically personal. We vary our language to meet circumstances and language forms cannot and should not be imposed on learners (WILLIS; WILLIS, 2010). However, what seems to be possible and desirable is to provide learners with opportunities to communicate and supplement this language development process with a focus on forms (SKEHAN, 1996).

This fact leads to the sixth and last proposition: Teaching for conformity to a standardized language norm is neither possible nor desirable. In other words, fulfilling the task is the primary goal. The role of the teacher should be to provide affordances from which students can learn. Thus, we consider that the teacher's role under the complex and TBL perspective is to disturb the students' learning system

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[2] According to Krashen (1982), there are two independent ways of developing ability in an L2. Acquisition is subconscious process identical in all important ways to the process children use in acquiring their first language, while learning is a conscious process that results in knowing about language.

(VETROMILLE-CASTRO, 2013), making it unstable as far as learning is concerned, helping students to create their meaning system.

Integrating Technology with Task-Based Learning under the perspective of Complexity Theory

This article uses Willis' TBL model (WILLIS, 1996), consisting of a pre-task phase, the task cycle, and a language focus phase and it aims to approach only the task cycle (task-planning-report) as a CAS as there are many similarities between this approach and second language development.

According to Larsen-Freeman (1997), these similarities are:
a) complexity scientist study complex nonlinear systems;
b) they are interested in how disorder leads to order;
c) how complexity arises in nature;
d) for some scientists, Complexity Theory is a process science rather than a state, of becoming rather than being (GLEICK, 1987).

The most relevant similarity, as far as we are concerned, is the last one. Learning a language is a process rather than a state. It is the act of becoming a better communicator/interlocutor rather than being one. It is a process without a goalpost, and for this reason, the term language development illustrates this phenomenon more appropriately under a CAS perspective than either language acquisition or language learning. By using "development" rather than "acquisition," de Bot & Larsen-Freeman (2011) want to make it clear that linguistic skills can grow and decline. It is implicit that there is no one point at which it can be said that a language is completely acquired. Its development is ongoing (DE BOT & LARSEN-FREEMAN, 2011).

According to Kenning (2007), although technological progress has affected how languages are learned and taught, it has not initiated a paradigm shift, which makes this area, in our view, a rich area to be academically explored. There is a growing number of studies yet modest about Technology-mediated Task-Based Learning and Teaching. Nowadays, it seems imperative to integrate computer and information technologies in education. This development is motivated by the unavoidable realizations that particularly new Internet-connected devices and digital technologies have become embedded in the life and learning process of many new generations of students (BARON, 2004).

Besides, it is clear, according to Chun *et al.* (2016), that it is not possible to "opt-out" of using technology: It is so pervasive and so interwoven with human activity that to teach language without some form of technology would create a limited and artificial learning environment.

Nowadays, we live in a society dominated by digital activities. We are surrounded by technology, and our daily activities are, most of the time, technology-mediated. It is indisputable nowadays that technology plays a vital role in our society. Technological learning affordances should also be used for learning a second language, in this case, English. Many scholars have already embraced TBL use in this technology-mediated environment, but it is still at its beginning. According to González-Lloret & Ortega (2014), theoretical frameworks that take the potentially transformative nature of technology seriously must be employed, and this is precisely what this article does by bringing the CT into technology-mediated TBL. It takes advantage of a new era of learners who are comfortable with innovation under the philosophy of "learning by doing." (GONZÁLEZ-LLORET, 2015).

To the best of our knowledge, there is no other research transferring CT to technology-mediated tasks and analyzing whether this theory would work in a virtual environment as well as it has worked in the traditional face-to-face one (LOPES JR., 2015). This article proposes to do precisely this, casting a complex look at the development of English as L2 mediated by computer technologies allowing space in the investigation for CT to contribute to second language development.

The technology-mediated tasks designed for this study followed the five characteristics proposed by González-Lloret & Ortega (2014), seen as necessary for any task but essential for technology-mediated ones. These characteristics are the following: Primary focus on meaning, goal-oriented, learner-centered, promote reflective learning, and tasks must be holistic. From these five characteristics, the most important one, as far as this study is concerned, is that tasks should focus primarily on meaning. This fact enables the emergence of meaning and, as a result, the emergence of a complex adaptive system. If language is not preplanned and emerges during meaning negotiation, unpredictability occurs, one of the main characteristics of a CAS.

According to Ziegler (2016a), during the last two decades, the body of research examining CALL has grown, with studies investigating a wide range of L2 areas of interest, including the development of linguistic, communicative, and intercultural competence. In her review

article, Ziegler (2016a) states that although these studies provide promising results regarding the efficacy and practicality of integrating task-based principles into computer-mediated language learning contexts, more research is needed to understand better how TBL might best be used to maximize the available affordances of technology-mediated learning. As benefits may vary across technologies, there is a growing body of evidence showing that the use of technology in task-based learning environments positively impacts a wide range of learning outcomes (ZIEGLER, 2016a).

Methods

This section provides details regarding the background of the study and participants, a description of the synchronous tool used for the classes and collecting data, and a brief description of the tasks used to create affordances for the emergence of a CAS[3].

Netnographic background

This study used a netnographic research method to collect and analyze data. Netnography is an adaptation of ethnography, which is participant observation but applied online to social media, communications, and connections people form online with one another (KOZINETS, 2010). We decided to use this method as it seems more appropriate to analyze an online learning environment for ESL mediated by a synchronous communication tool. There are five steps to a netnographic method, and these steps are here considered as the enabling constraints which, along with the tasks, create the affordances for the emergence of a complex system. The five stages, according to Kozinets (2010), are the following: The definition of research questions, community identification and selection, engagement and immersion in the community and data collection, data analysis and iterative interpretation of findings and writing, presenting and reporting research findings. This study followed these steps by establishing the research questions, identifying and describing the students' community; the teacher was then engaged in the classes and collected data by recording the lessons for later analysis, and we now report the findings.

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[3] We carried out this investigation during 2019 before the Covid-19 pandemic broke out. Little did we know that online classes would become commonplace by March 2020.

Participants

The present study focuses on a group of students (8) who voluntarily participated in online ESL classes while pursuing either an undergraduate or a graduate degree in Biotechnology at the Federal University of Pelotas/Brazil. We selected students who needed to have online meetings with researchers from international universities. They were attracted to the study mainly due to its context: Classes were offered online using Zoom, meaning that they would attend the lessons from home or even from the laboratories at the university. They would practice conversation in an online environment developing not only proficiency in English but also digital literacy as synchronous communication programs have become efficient tools to exchange knowledge with foreign universities.

The synchronous communication tool

After evaluating a few synchronous communication tools such as Skype, FaceTime, and Google Hangouts, we decided to use Zoom for the online classes. This software is a synchronous communication software used to connect people for online meetings which presents the following advantages:

a) the software presents a recording feature that is extremely valuable for future analysis;

b) Zoom displays a feature called 'breakout rooms' where students work in pairs or small groups. This feature is very relevant when using TBL, mainly during the task phase when students carry out the task with their partners away from the teacher's and peers' scrutiny. These rooms can also be recorded for further analysis;

c) the teacher has total control of all the features of this new online classroom, such as sharing the screen with the students making the correction of exercises more practical;

d) there is also a chat box where the teacher can communicate with all the students or just with one helping in the spelling of words and sharing documents used as homework;

However, one disadvantage of Zoom is that it is free for the first 45 minutes, so in the case of longer lessons, the teacher would have to pay to use it. A way around would be to limit a class to 45 minutes

and then start another one. Zoom's negative point is easily overcome by the positive aspects mentioned above and excellent functionality even when participants have low bandwidth.

Tasks

Participants were exposed to five tasks over a period of five weeks (one task each week). The tasks used to collect data for this study approached the following topics: Task one – talk about your dreams, ambitions, and achievements; Task two – Decide how to spend lottery money; Task three – Make a list of things you'd hate to be without; Task four – Find things in common, and Task five – Talk about someone you admire. Tasks were adapted from New Cutting Edge Intermediate Student's book (CUNNINGHAM, S. & MOOR, P., 2005) at the B1 level of The Common European Framework of References for Languages (CEFRL[4]). At this level, students can engage in real–time online exchanges with more than one participant, recognizing each contributor's communicative intentions, but may not understand details or implications without further explanation.

Interviews

We carried out two interviews with the participants in the study. Before classes started, we performed the first one regarding students' previous experience with learning English. In the second, conducted at the end of the course, we asked questions about students' opinions regarding the tasks they performed in the technology–mediated environment. We conducted both interviews online also using Zoom.

Findings and Discussion

Technology–mediated Task Cycle as a Complex Adaptive System

Larsen–Freeman (1997) describes a CAS as follows: Chaotic, unpredictable, sensitive to initial conditions, dynamic, complex, non–linear, open, self–organizing, feedback sensitive, and adaptive. These characteristics do not operate alone but are interconnected, and this connection leads to the emergence of this kind of system. We now

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[4] For further information on the CEFRL please refer to the following link: <https://rm.coe.int/cefr-companion-volume-with-new-descriptors-2018/1680787989>.

demonstrate how these characteristics emerged in the technology-mediated task cycles to answer one of our research questions: Is it possible to characterize the task cycle as a complex adaptive system in this technology-mediated environment? The complex characteristics of the task cycle are presented in groups.

Chaotic, unpredictable and sensitive to initial conditions

Chaos is linked to constant changes and sometimes chaotic in character in which the system is temporally nested into so-called attractor states (DE BOT & LARSEN-FREEMAN, 2011). This characteristic emerged more than once during our study, and the next example illustrates one of these occasions: One pair, upon finishing the second task, started talking about random topics. First, they talked about Zoom's recording system, then about issues related to their university lives, after that about how one of them gets easily upset, and at the end, they talked about Game of Thrones[5]. The system changed chaotically, accommodating itself in attractor states until one of the students decided to close the breakout room and return to the main room. After chaos, also considered the ideal time for learning, a new order appears, not a static final product but as a process, that is, a process in constant development (PAIVA, 2011).

According to Larsen-Freeman (1997), the main reason for the unpredictable behavior of a CAS is their sensitive dependence to initial conditions as slight changes in initial conditions may have considerable implications in future behavior as can be seen in the following example: During the third task, making a list of things you'd hate to be without, at the moment students were allocated to the breakout rooms, they showed each other their cats and started talking about pets in general. They did not include their cats into their lists as they do not consider them things. At the end of this brief conversation about pets, one of the students proposed to start the task. The cats were the initial conditions the system was sensitive to, and the unexpected topic emerged.

Dynamic, complex and nonlinear

The technology-mediated task cycle is dynamic as it changes over time. After these changes occur, the observer may look back and

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[5] A famous television series created by David Benioff and D.B. Weiss for HBO.

describe the emergent pattern based on the interactions of variables of the system. It was possible to identify this characteristic more than once and sometimes associated with another one. The fourth task's report stage (Find things in common) presented itself as dynamic as there was a considerable change in the course of the conversation when one of the students said that he would like to live in Canada. All students wanted to contribute, showing that they would also like to live in a different country. The dynamic nature of the task cycle was evident as there was a significant change in the conversation towards a new attractor state. It remained in this stage for the whole period of reporting. Being complex does not mean it is complicated, but that there is more than one variable in interaction. This interconnectivity makes the complex nature of the task cycle as a CAS emerge. In the previous example, we identified unpredictability when the students started talking about Canada, which was unexpected. The interaction of these two variables – dynamic and unpredictable – makes the system also complex.

The technology–mediated task cycle is also nonlinear; that is, the cause is not proportioned to the effect. In other words, when we wish to learn vocabulary in a second language, we tend to think that if we invest more time in studying vocabulary, we will learn more. This relationship is not accurate for the task cycle in this new learning environment, where cause and effect are not always present. The nonlinearity means that playing the game has a way of changing the rules (GLEICK, 1987), which happens precisely in the report stage when all students decide to talk about where they would like to live if they could choose to.

Open, self–organizing, feedback sensitive and adaptive

The technology–mediated task cycle is open not only as it develops and increases in complexity through constant change but also because it depends on its internal and external resources. The task cycle in this new learning environment is open to change and is influenced by its agents. This characteristic of a CAS was identified in the third task cycle (Making a list of things you'd hate to be without) when a student, who was participating in the class from her university laboratory, was interrupted by one of her lab colleagues to whom she had to give instructions. The student and her colleague's conversation disturbed the online environment exactly when the teacher was assigning the task.

The teacher decided to revise the instructions when her conversation finished, and her attention was directed to the class again.

As the task cycle is open and sensitive to external agents, it is also self-organizing due to internal reorganization. Changes are caused by interaction with the environment leading to the emergence of order. Self-organization in the task cycle as a CAS is possible due to its agents' interaction: Student, teacher, and communication tool. During the second task, one student receives and accepts feedback from her pair regarding the pronunciation of "divide." Her system reorganizes itself, and she does not make the same mistake again. In a technology-mediated task cycle as a CAS, there are always two forces in action: Interaction between its agents and internal self-organization.

The task cycle is feedback sensitive, and this characteristic is connected to iteration, meaning that the present level of development depends critically on the previous one (DE BOT & LARSEN-FREEMAN, 2011). This characteristic emerged during the task cycle more than once, and the dialogue below represents one of these occasions:

A: My last dream would be to meet my favorite band!

B: Go to a concert?

A: Go to a concert, of course!

B: Which band is?

A: It's Sonata Arctica, I am not sure how to pronounce it.

B: Oh!

A: It's a Finnish band? Yes, it's a Finnish band!

B: a what?

A: a Finnish band …. From Finland!!

B: Ok!! Cool!!

Students talk about their dreams, ambitions, and achievements in the first task, and the cycle is feedback sensitive when student A talks about a Finnish band. However, his colleague does not understand and asks for clarification. A student then changes his sentence and says, "a band from Finland," making the meaning clear. We can also characterize the task cycle, at this point, as adaptive. The cycle does not respond passively to the events but tries to turn what happens to its advantage (LARSEN-FREEMAN, 1997). It is a system linked to changes based on the interaction among its agents, and as a consequence of this change, it adapts to a new stage, which we can precisely see in the dialogue above.

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Contributions from participants

The final interview was useful to corroborate data identified during the class and describe the technology–mediated task cycle as a CAS. The participants, who did not have any information about Complexity Theory, were able to identify, using their own words, the characteristics of a CAS during the task cycles. One student realized that the task cycle in this new environment is sensitive to initial conditions. She mentioned that she liked the classes because the teacher provided the task for the students to talk about, making the lessons more objective. In her words, she classifies the task and instructions provided to perform it as initial conditions so that the task cycle as a CAS can emerge. Another student said that she enjoyed performing the tasks and added that she had never had any formal English lessons, either face–to–face or online, which is why everything was new. Her statement shows that the task cycle is chaotic, but not in the sense of disorder but in the Greek sense, connected to Chaos Theory, meaning the void space preceding creation, in this case learning.

Another participant identified the emergent and complex character of the technology–mediated task cycle. Based on his experience and comparing regular and online classes, he considers that the latter provided more opportunities for conversation. He could not further explain this impression, but we could attribute it to the teaching approach in the regular classes, which was different from the technology–mediated classes. He also identified the nonlinear feature of such a system by saying that although the lessons were not focused on grammar, he noticed that he learned some relevant grammar aspects by the end of each class. As an example, he learned that the word "equipment" has no plural in English, so he should say 'two pieces of equipment' to express inflection for number. This example illustrates that cause is not proportioned to effect. The interaction among the agents of the task cycle makes the emergence of a complex system possible not only during the task but also during the task cycle.

A third student identified that the task cycle is open, taking in outside information and reorganizing it. She mentioned that online lessons enable students to use the internet to clarify pronunciation and vocabulary while participating in the class. The task cycle is always open to change and, therefore, can be influenced by its agents, for better or for worse (LARSEN–FREEMAN, 2017). This fact also shows that the

cycle is dynamic and that changes are constant and sometimes chaotic. Another student, using her words, identified the task cycle as dynamic as doubts and questions regarding grammar and vocabulary emerged along the task's performance.

A different participant highlighted that students become more autonomous during the task cycle and do not suffer influence from the teacher or other classmates. She believes that students are free to say what they want to the way they want to (unpredictable system) and can work collaboratively during the task, correcting her classmates and being corrected. In other words, this collaborative way of correcting each other shows that when students receive feedback, the task cycle changes based on the interaction between the two students in each pair. As the cycle is feedback sensitive, once again, internal reorganization takes place. The same student identified that the technology-mediated task cycle is adaptive as it can learn due to experience (LARSEN-FREEMAN, 2017). The cycle is an adaptive system as it changes in response to the changes that occur during its performance. She mentioned that students with different learning styles could have classes at the same proficiency level. The task cycle adapts itself to its agents' needs and responds to these needs by using these changes to its benefit. Learners are not engaged in learning phrases, but in learning how to co-adapt their behavior to an environment which is more and more complex (LARSEN-FREEMAN, 2011).

Another relevant input from all the participants was that 50% would like to continue having classes online. They would opt for online courses, according to them, as they can take part in the lesson from wherever they are and do not waste time commuting to a school. However, the other 50% would prefer regular face-to-face classes and presented as their main reason the social factor, that is, meeting their friends and teacher face-to-face would favor their learning style.

Final words on the findings

The reasons the participants stated in the previous paragraph for either having or not having classes in an online environment mediated by a synchronous communication tool indicate new research directions in the area of technology-mediated task-based learning. However, it is relevant to highlight that students opted for regular face-to-face classes due to social aspects and did not criticize the synchronous

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communication tool. They demonstrated interest, enthusiasm, and good results when using TBL to learn English. They pointed out that their preference for regular classes is predominantly social as they value being near friends. This opinion might change if regular classes are prevented from happening due to weather–related causes or even when participants are from different parts of the country or world.

Discussion

This study analyzed the teaching/learning process of English as L2 in CALL, emphasizing oral interaction in an environment mediated by Zoom using Task–Based Learning under Complexity Theory. Based on the findings of our analysis, we answer and discuss each research question below:

Research question 1: Is it possible to take TBL to an environment mediated by a synchronous communication tool, a technology widely available nowadays? The simple answer is that it is possible to use TBL in this new learning context. Our study has demonstrated that this strong approach to teaching/learning English as L2 (ELLIS, 2003) fits well with this new synchronous environment.

Research question 2: What are the positive and negative aspects of this transposition? One of the positive aspects is that the combination between technology and tasks provides affordances for meaningful use of the English language once students focus on communication rather than form, and the need to convey meaning emerges from these affordances. It is a student and learning–centered process in which the aim is to finalize the task using linguistic and nonlinguistic resources and students' digital literacy. Another positive aspect is that providing affordances for learning English also creates conditions for a collaborative and reflexive learning process. These affordances provide students with opportunities for learning by doing and gives them options to consider the process as a whole, encouraging them to take an active role in their learning process. The breakout rooms, a Zoom feature that makes it possible to put students in separate rooms when performing the task, is another positive aspect of our research. It resembles the regular TBL classroom when students work in pairs without the scrutiny of the teacher or peers. Being able to record the breakout rooms for future analysis was another benefit of this Zoom feature.

Research question 3: Is it possible to analyze the learning process of English as an L2 with emphasis on oral interaction under the perspective of Complexity Theory in this new learning environment? The response to this question is that there are many similarities between Complexity Theory and second language development (LARSEN–FREEMAN, 1997). This theory, considered a metatheory, provides different lenses through which researchers can analyze language development, focusing on the learning process. According to Larsen–Freeman (2017), the concepts of this theory allow researchers to trace and describe emerging patterns in dynamic systems to explain change and growth in language development.

The aim of this study was not to prove how one learns English as an L2 but to search for improvements regarding the learning process using the theoretical assumptions of CT. When answering this question positively, we aim to contribute to the Applied Linguistics area by bringing Complexity Theory to CALL, an environment to which this theory was not initially conceived for, using theory instantiation (HUBBARD & LEVY, 2016). In other words, this study used CT, now in a technology–mediated learning environment, therefore creating a new instance of theoretical application.

Research question 4: Is it possible to characterize the main stage of this approach – the task cycle – as a complex adaptive system in this technology–mediated environment? The answer to this question is again positive. During the analysis of the five technology–mediated tasks, it was possible to identify the ten characteristics of a CAS. Also, the participants' final interview corroborated these findings; even without knowing about the characteristics of a CAS, they managed to identify them using their own words.

Research question 5: To what extent is TBL suitable to adapt to future technologies not available to the ESL classroom yet, such as AR? After showing that it is possible to use TBL in an environment mediated by a synchronous communication software, we can say that TBL is ready to adapt to new technologies that might emerge either in regular classrooms or online ones. Another reason is that the task cycle, the core phase of TBL, was characterized in our study as adaptive. So, it easily adapts to a new technology–mediated environment. It is also dynamic and unpredictable, showing that TBL principles apply not only to today's current technologies but also to those yet to be introduced in the language development area, such as AR, and to those yet to be invented.

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Final considerations

This paper attempts to contribute to the development of a new area of investigation in CALL. According to Ziegler (2016b), there is a growing need to better understand the pedagogical implications of interactions in the computer-mediated context. Based on her meta-analysis (ZIEGLER, 2016b), she states that despite the availability of video-chat programs such as Skype, Google Hangouts, there has been relatively little research conducted using audio and video modalities. Exploring this new learning space to understand it better and use it is once again necessary if we follow Chun's (2016) proposal, which suggests that the areas of CALL and SLA (development in his paper) should become naturalized and normalized. In other words, a stage in which technology is completely integrated to teaching and learning an L2 and is no longer exceptional or unusual, in the way that books, pencils, and blackboards were in the traditional classrooms (CHUN, 2016). With this in mind, we have tried to further current knowledge and practice of Technology-mediated Task-Based Learning from a complexity theory perspective. Although CT has contributed to and influenced our understanding of second language development, such an approach has not yet been widely adopted in CALL (SCHULZE, 2017). Approaching the process of learning/teaching English as L2 under the perspective of a CAS and Complexity Theory is not an easy task. However, this approach reflects how complex the world we live in is, which is also increasingly technological and nonlinear. The interactions among all variables and subsystems bring out the dynamic and complex character of language learning.

Perhaps the complex paradigm is not a convenient choice to analyze data. However, we agree with de Bot *et al.* (2013) when they say that an alternative to this approach would be to pretend that an L2 is acquired and not developed and that this acquisition takes place in a linear way with an exact endpoint. In our eyes, as experienced English teachers and researchers in the area, the way an L2 develops is a nonlinear process that is continuously changing. Reductionist approaches have not successfully contributed to explaining the phenomenon of learning an L2 (LEFFA, 2009). Therefore, based on the data presented, we are convinced that it is not feasible to pretend that English as an L2 is acquired and not developed. The perspective of complex adaptive systems attempts to shift this linear and reductionist paradigm when addressing ESL development (LARSEN-FREEMAN, 2017).

In closing, this study aimed to bring TBL to a technology-mediated environment using a synchronous communication tool (Zoom). It is an approach that creates more affordances for the learning process to take place in a non-reductionist way. In this new learning/teaching environment, TBL enables the emergence of a complex adaptive system due to the interaction of all agents and creates the affordances for students to elaborate and expand knowledge.

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