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RESEARCH ARTICLE

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Revitalizing double-loop learning in organizational contexts: A systematic review and research agenda

Mercedes Victoria Caceres Auqui | **Andrea Furlan**

Department of Economics and Management, University of Padova, Italy

Correspondence
Mercedes Victoria Caceres Auqui, Department of Economics and Management, University of Padova, Italy.
Email: mercedesvictoria.auquicaceres@unipd.it

Abstract

Argyris & Schön's notion of two types of learning, single-loop (SLL) and double-loop learning (DLL), is arguably one of the most popularized categorizations of organizational learning (OL). However, while the concept of DLL is widely cited, it has left a superficial impact on the literature and practice. We argue that the limited impact of DLL is due to two features of DLL: the complexity of its definition and the difficulty in its implementation. This study identifies and organizes critical insights in the literature related to the conceptualization, measurement, and generation of DLL. To address these topics, we review and synthesize the findings of 128 studies on DLL published between 1974 and 2021. We aim to reduce the confusion surrounding DLL and the proliferation of empirical studies on DLL that ignore its original notion. We propose a framework that makes explicit the misconceptions, wrong assumptions, and barriers in conceptualizing, measuring, and generating DLL, and it also provides insights into how to overcome these limitations and serves as a platform for future research on DLL.

KEYWORDS
double-loop learning, organizational learning, systematic literature review

INTRODUCTION

Scholars generally agree that one of the most important typologies of organizational learning (OL) distinguishes between single-loop learning (SLL) and double-loop learning (DLL). This distinction was initially made by Argyris & Schön (1974, 1978). SLL occurs when organizational members attempt to correct the mismatches between intentions and outcomes simply by changing their actions without questioning or altering the governing values (values, belief, and assumptions) underlying those actions, whereas DLL occurs when "mismatches are corrected by first examining and altering the governing variables and then the actions" (Argyris, 1999, p. 68).

Argyris & Schön's (1974, 1978) ultimate aim was to help organizations to develop DLL capabilities. Their effort is aimed at transforming an organization into a "DLL organization". Although the concept of DLL was introduced in 1974, it has been cited by more recent theories on OL. For example, both Pedler et al.'s (1989) model on the "learning company" and Senge's (1990) model on the "learning organization" refer to the concept of DLL. Pedler et al. (1989, p. 97) recognize that the type of learning behind a learning company (i.e., an organization able to innovate) should be of "double-loop nature". Similarly, Senge (1990) argues that to become a learning organization (i.e., an organization able to survive in a hectic environment that requires rapid changes), "adaptive learning must be joined by 'generative learning', learning that enhances our capacity to create" (Senge, 1990, p. 14). Generative learning involves changing mental models defined as "deeply ingrained assumptions or generalizations that influence how we understand the world and how we take action" (Senge, 1990, p. 11), which is one of the fundamental notions of DLL.

However, as Lipshitz (2000, p. 468) argues there is "an evident gap between the frequency and the profoundness of references to Argyris & Schön's work in the literature". Indeed, given the widespread attention that DLL has received in management literature, one would expect that DLL would have much to contribute to the body of research on OL, but DLL left a noticeable but superficial impact on the literature and practice (Lipshitz, 2000; Witherspoon, 2014).

The superficial impact of DLL is even more surprising given the recent rise of theory-based learning in management literature (Ehrig & Schmidt, 2022; Felin & Zenger, 2009). Scholars advocating this approach suggest that strategists should design experiments to test their hypothesis, learn from these experiments and possibly revise their beliefs about successful courses of action in the light of the unfolding evidence. Even if this idea of learning is clearly in line with the theory on DLL, theory-based learning scholars do not make use of any concept from Argyris & Schön's framework.

We suspect that the limited impact of DLL can be traced back to two features of the original conceptualization of DLL: the complexity of its definition (Jaaron & Backhouse, 2017; Lipshitz, 2000; Mazutis & Slawinski, 2008; O'connor & Kotze, 2008) and the difficulty in its implementation (Bochman & Kroth, 2010; Choularton, 2001; Henderson, 1997; Lipshitz, 2000; Mazutis & Slawinski, 2008; McAvoy & Butler, 2007; Tsuchiya, 1998; Wong, 2005). The purpose of this study is to identify whether misconceptions or wrong assumptions exist in the management literature when it comes to define or implement DLL. We attempt to address this issue by conducting a systematic review of the literature on DLL, focusing on (a) verifying the consistency of the studies with the original conceptualization of DLL and (b) finding the main difficulties in operationalizing DLL. A thematic analysis suggests that the literature can be organized along three key categories (a) how to conceptualize DLL, that is, studies that mainly provide theoretical contributions to the conceptualization of DLL, (b) how to measure DLL, that is, studies that predominantly employ methods or tools for the measurement of DLL, and (c) how to generate DLL, that is, studies that primarily provide models, methodologies, or mechanisms focused on overcoming the difficulties and obstacles to produce DLL. From a critical analysis of the literature, we provide a framework with key insights that seek to revitalize the conceptualization, measurement, and implementation of DLL. We argue that clarifying the concept and operationalization of DLL can be helpful to a variety of different streams of research on problem solving, OL, and organizational innovation.

We begin this article by providing the research background on DLL to clarify its nature and original notions. We then discuss the motivation for our literature review and present the method and findings of our review and finally we present our conclusions and future research avenues.

THEORETICAL FRAMEWORK

Organizational learning

Learning can be defined in many ways. For the purpose of this study, learning occurs when new understanding or insights are connected with new behaviors or actions (Argyris & Schön, 1996). Argyris & Schön have referred to learning as new insights or knowledge (Fiol & Lyles, 1985) that challenges the assumptions about what is known or done (Di Bella & Nevis, 1998).

Although there have been many reviews of the OL literature, there does not appear to be a widely accepted definition of OL (Bontis et al., 2002; Fiol & Lyles, 1985). Two of the most used definition of OL were provided by Argyris & Schön (1978) and Fiol & Lyles (1985). Argyris & Schön defined OL as the process of detecting and correcting errors. Fiol & Lyles defined OL as the process of improving actions through better knowledge and understanding. However, it appears to be some agreement on the need for a distinction between individual learning and OL. As Bontis et al. (2002, p. 444) claim "organization level learning involves embedding individual and group learning into the non-human aspects of the organization including systems, structures". Indeed, organizations learn when they "encode inferences from history into routines that guide behavior" (Levitt & March, 1998, p. 319). Organizations do not have brains, but they have cognitive systems and memories to store the learning they create (Hedberg, 1981). For Huber (1991, p. 89) an organization learns "if any of its units acquires knowledge that it recognizes as potentially useful to the organization".

Although literature offers diverse theoretical OL perspectives (Bontis et al., 2002), the theoretical foundations of the current study are based on the "theory of action" developed by Argyris & Schön (1974, 1978). We focus on this theory of action because it is one of the most cited theories in the OL field (Fulmer & Keys, 1998; Lichtenstein, 2000; Remedios & Boreham, 2004; Bochman & Kroth, 2010). A comparison of different theoretical approaches in the OL domain is beyond the scope of this paper.

Model I and model II theory-in-use

Argyris & Schön (1974, 1978) state that all human action is based on theories of action. Individuals carry around their governing variables about how they and others should behave. According to Argyris & Schön, these governing variables can be stated in the form of propositions or causal representations, that is, "if I behave in such and such a manner, then the following consequences should occur" (Argyris, 1999, p.179). Since these propositions can be seen as propositions in any scientific theory, they called them “theories of action”. Argyris & Schön maintain that individuals hold two theories of action: a) espoused theory is the theory to which human agents claim allegiance. Espoused theory is the set of rules that individuals use to design the actions they say they will take in a particular situation, and b) theory-in-use is the set of rules that individuals use to design the actions they actually take in a specific situation. Theory-in-use is the theory that can be deduced from agents' behavior or action. Argyris & Schön focus on understanding the connection between thinking (our espoused theory) and doing (our theory-in-use).

Argyris & Schön (1974, 1978) maintain that there are two types of theory-in-use, that is, Model I and Model II theory-in-use. The final purpose of an individual using Model I theory-in-use is to “avoid embarrassment or threat, feeling vulnerable or incompetent” while the final purpose of an individual using Model II is to “use valid information to promote free and informed choice” (Argyris, 1999, p. 131). They assert that theory-in-use of nearly all people studied by them is consistent with a behavioral master program of Model I. Despite all the evidence which suggests that people's theory-in-use is consistent with Model I, Argyris & Schön document that most people espouse Model II even when they really act consistently with Model I theory-in-use. Table 1 summarizes details about the main characteristics of Model I and Model II theory-in-use.

Argyris & Schön (1978) state that individuals adopting Model I theory-in-use create a behavioral system that they called “Model O-I” (“O” signifies “organization”), which is a model of a limited OL system. This model creates primary inhibiting loops when organizational agents deal with embarrassing and threatening problems. Individuals “distance themselves from taking responsibility, losing, and suppressing negative feelings, especially those associated with embarrassment and threat” (Argyris, 2005, p. 440). In contrast, “Model O-II” describes the behavioral system created by individuals who adopt Model II theory-in-use. An OL system dominated by individuals programmed with Model I theory-in-use inhibits the production of DLL. Instead, in a learning system with a prevalence of individuals using Model II theory-in-use, both SLL and DLL can be produced.

TABLE 1 Characteristics of model I and model II theory-in-use.

Governing variables for action held by users	**Model I** • Be in unilateral control of situations • Maximize winning and minimize losing • Minimize generating or expressing negative feelings • Be as rational as possible	**Model II** • Utilize valid information • Promote free and informed choice • Assume personal responsibility and constant monitoring on the implementation
Action strategies of actor	**Model I** • Design and manage the environment unilaterally • Own and control the task • Protect oneself and others unilaterally	**Model II** • Design environment where participants can share control • Task is controlled jointly • Protecting oneself and others is a joint enterprise
Consequences on actor and his associates	• Defensive interpersonal and group relationships • Defensive norms • Low freedom of choice, internal commitment, and risk taking	• Minimally defensive interpersonal and group relationships • Learning-oriented norms • High freedom of choice, internal commitment, and risk taking
Consequences on learning	• Reduced production of valid information • Little testing of ideas and theories publicly • People tend to become self-sealing • Single-loop learning • Effectiveness in problem solving tend to decrease	• Testable processes • Public testing of ideas and theories • People tend to become open-transparent. • Double-loop learning • Increased long-run effectiveness in problem solving
Reasoning process	**Defensive reasoning** ***Characteristics***: soft data, tacit and private inferences, conclusions not publicly testable. ***Supported by***: tacit theory of dealing with threat, a set of tacit interrelated concepts, a set of tacit rules for using concepts to make permissible inferences, reach private conclusions, and private criteria to judge the validity of the test.	**Productive reasoning** ***Characteristics***: hard data, explicit inferences, premises explicit, conclusions publicly testable. ***Supported by***: (explicit or tacit) theory of strategy formulation, set of directly interrelated concepts, set of rules for using concepts to make permissible inferences, reach testable conclusions, and criteria to judge the validity of the test.

Source: adapted from Argyris (1977, p. 118; 1999, p. 180, 182, 243–245).

Single-loop and double-loop learning

Argyris & Schön (1978) define OL as the process of detecting and correcting errors, and they argue that, at the organizational level, learning may occur under two conditions. First, learning takes place when the consequences of the action strategy are as the organization intends, then there is a match between its design for action and the actuality or outcome. Second, learning may occur when “a mismatch between intentions and outcomes is identified and it is corrected; that is, a mismatch is turned into a match” (Argyris, 1999, p. 67). Learning occurs when “errors are not simply detected; they are also corrected and correction implies action”

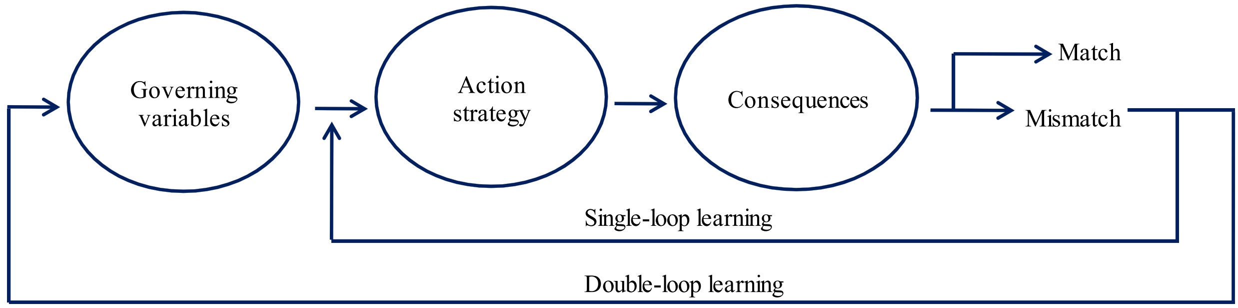

FIGURE 1 Single-loop learning and double-loop learning. Source: adapted from Argyris (1999, p. 68).

(Argyris, 2003, p. 1179). Error or failure offers valuable opportunities for learning (Sitkin, 1992) because it prompts an inner sense of discomfort and awareness that may disrupt habits of perceiving, thinking, or acting (Louis & Sutton, 1991).

Argyris & Schön (1978) claim that there are two possible responses to correct an error, and these are represented by the concepts of SLL and DLL, which are diagrammed in Figure 1. This distinction is probably the most popular categorization of OL. Argyris & Schön's work is widely cited in the OL literature (Bochman & Kroth, 2010; Cope, 2003; Deverell, 2009; Lipshitz, 2000). As Deverell (2009, p. 181) argues, "other theorists have presented similar categorizations, but none has been cited with such intensity".

The first type of response (i.e., SLL) implies that individuals search for other action strategies to achieve the same desired consequences. This kind of learning occurs when "an error is detected and corrected without questioning or altering the underlying values of the system" (Argyris, 1999, p. 68). In the second type of response (i.e., DLL), the agent does not merely search for alternative actions to achieve her same ends; she also examines the appropriateness and propriety of her chosen ends. DLL occurs when "mismatches are corrected by first examining and altering the governing variables and then the actions" (Argyris, 1999, p. 68).

In this article, governing variables are defined as values, beliefs, or assumptions that actors need to operationalize or satisfy, and action strategies are "sequences of moves used by actors in particular situations to satisfice among governing variables" (Argyris, 1991, p. 242). These governing variables are not related to the values, beliefs, or assumptions people espouse; instead, they are the values, beliefs, or assumptions people actually use to drive their actions.

Defensive routines and DLL

Argyris & Schön document that the individual reasoning behind Model I is a "defensive reasoning" which is a reasoning process that encourages people to "keep private the premises, inferences, and conclusions that shape their behavior and avoid testing them in a truly independent and objective fashion" (Argyris, 1999, p. 131). The main purpose of defensive reasoning mindsets is to protect agents, groups, or organizations from difficult and threatening problems. Defensive reasoning prevents people from inquiry and reflection, which are the foundations to develop DLL. Model O-I systems produce organizational defensive routines, which are defined as "any policy, practice, or action that prevents embarrassment or threat to the players involved, and, at the same time, prevents learning" (Argyris, 1999, p. 166). These defensive practices occur routinely in work settings and are "caused by a circular self-reinforcing process in which individual's Model I theory-in-use produce individual strategies of bypass and cover up, which result in organizational bypass and cover up, which reinforce the individual's theory-in-use" (Argyris, 2005, p. 444). Defensive routines are automatic, normal, and natural, "they are the emotional heritage of the primitive fight-or-flight response meant to protect us in times of danger" (Noonan, 2007, p. 57) and are organizational because "individuals with different personalities behave in the same way; people leave and new ones come into the organization, yet the defensive routines remain intact" (Argyris, 1999, p. 141).

Action research to generate DLL

Argyris & Schön claim that it is possible to intervene to help individuals learn in a double-loop mode, which means moving from Model I theory-in-use to Model II theory-in-use. To manage this transition, Argyris & Schön draw on collaborative action research (Lipshitz, 2000). They rely on action research cycles since this type of research approach tends to be undertaken when the phenomenon is a social one, emerging out of the actions and interactions of agents over time. Even though Argyris & Schön "provide detailed descriptions of their heuristic efforts and of partial successes in achieving this difficult transition", they "do not offer n-step algorithms" to get from Model I to Model II (Lipshitz, 2000, p. 470). From empirical research conducted by Argyris & Schön, we can identify a structure of their intervention programs based primarily on direct observation (Argyris, 1993; Argyris et al., 1985; Argyris &

Schön, 1996). The first phase is to observe the individuals to diagnose their theory-in-use model and to collect data to infer the individuals' governing variables. They also interview participants to capture their espoused theory. In a second phase, the results of the first stage are shown to the participants for their feedback to enrich the preliminary model inferred. The third phase focuses on the use of a case study instrument, called "the left-and-right-hand column case method" to observe the individuals' defensive routines. The last phase is to implement a change program to help individuals redesign their actions. In sum, Argyris & Schön employ a methodology based on self-designed experiments that allow participants, guided by a facilitator, to be aware of the inconsistency between their theory-in-use and their espoused theory. Next, they help organizational agents develop Model II skills by learning a new set of governing variables, to modify their behavior. This new behavior is practiced repeatedly until it becomes an unconsciously performed routine.

SYSTEMATIC LITERATURE REVIEW

Motivation

The seminal idea of DLL for individuals and organizations developed by Argyris & Schön (1974, 1978) is widely cited in the OL literature (Bochman & Kroth, 2010; Cope, 2003; Deverell, 2009; Lipshitz, 2000). Nevertheless, as Witherspoon (2014, p. 279) argues, Argyris & Schön's work "has fallen short of its potential contribution to practice". Similarly, Lipshitz (2000, p. 456) claims that "Argyris and Schön's work is frequently referenced but rarely followed or fully understood" in the literature of OL.

We argue that DLL has a superficial impact on the literature and practice for two reasons: (1) DLL is a complex concept to understand, and (2) DLL is difficult to implement.

Jaaron & Backhouse (2017, p. 321) posit that DLL is an "inherently complex concept". As some researchers claim, Argyris & Schön's work is written with scientific rigor that could be considered complex, for some readers or practitioners (Mazutis & Slawinski, 2008) and exhausting (O'connor & Kotze, 2008). As Mazutis & Slawinski (2008, p. 438-439) state, the complexity of Argyris & Schön's arguments lies in an inadequate understanding of the "incongruence between espoused theory and theory-in-use" and the "difficult concepts" linked to "Model I and Model II" theory-in-use. They claim that the difficulty in understanding DLL takes root in its "conceptualization as a dynamic process through which the thoughts and actions of individuals and groups change". For Lipshitz (2000), the conceptual notions are hard to understand because of the difficulty in comprehending the basic rationale and essential elements of Argyris & Schön's conceptual framework, particularly, a poor understanding of the "two interpersonal theories of actions, referred to as Model I and Model II, and the corresponding organizational-level theories of actions, Model O-I and Model O-II" (Lipshitz, 2000, p. 462).

Regarding the difficulty to implement the concept of DLL, researchers recognize the struggle in developing or mastering DLL in organizational contexts (Bochman & Kroth, 2010; Henderson, 1997; Tsuchiya, 1998). Some scholars and critics claim that achieving DLL is "extremely difficult" (Lipshitz, 2000: 470), "problematic", and "does not occur easily" (Choularton, 2001, p. 67). The inherent difficulty of realizing DLL may be related to the fact that individuals are "unaware of the contradiction between their espoused theory and their theory-in-use, between the way they think they are acting and the way they really act" (Argyris, 1999, p. 131). People can "see the variance between another team member's espoused theories versus their theories-in-use more easily than they can identify their own espoused theories and theories-in-use" (McAvoy & Butler, 2007, p. 557). Some researchers argue that the reason DLL rarely occurs is because individuals are "unaware of their own biases and unaware that they are not open to having their ideas challenged" (Mazutis & Slawinski, 2008, p. 448) and they are "unaware of what they themselves are doing" (McAvoy & Butler, 2007, p. 557). This difficulty is compounded by the fact that even if agents become aware of these inconsistencies, they are not able to "change their modes or frames of reasoning as they judge the appropriateness of their attitudes and behaviors based on past knowledge" (Wong, 2005, p. 339), blocking the generation of DLL.

We suspect that these two features of DLL – a complex concept to understand and difficult to implement – have led to misconceptions or wrong assumptions in correctly defining and implementing DLL thus limiting its impact in management theories and practice. Our literature review is aimed to identify these misconceptions or wrong assumptions surrounding DLL and, by doing so, increasing the awareness of researchers and practitioners of their existence.

We believe that a revitalization of DLL can be useful to a variety of different theories and bodies of research. For example, clarifying the concept and operationalization of DLL can shed light into the mechanisms of the problem-solving process and the micro-foundations of strategic and organizational innovation.

As Furlan et al. (2019) point out, a systematic problem-solving requires open and transparent discussion of beliefs and assumptions of the organizational members (the foundation of DLL). Along the same line, Kululanga et al. (1999) maintain that DLL seeks thorough rather than discrete solutions to avoid recurrence of the same problem. Following Wong et al. (2008, p. 164), the problem-solving process behind DLL is characterized by (1) "identifying the root causes of the problem before taking action", (2) "changing the current working performance" by "scrutinizing the underlying assumptions that had led to the difference between the expected and the obtained outcomes", (3) "seeking and adopting alternative performance improvement methods". Tucker et al. (2002, p. 124) argue that similarly to the concepts of SLL and DLL, "research on problem-solving makes a distinction between fixing problems (first-order solutions) and diagnosing and altering underlying causes to prevent recurrence (second-order solutions)".

The literature on innovation acknowledges that innovation is the result of a systematic problem-solving process that involves individuals and teams within and across organizations. For example, Tucker & Edmondson (2003, p. 61-62) maintain that "real change is achieved" only by "second-order problem-solving behaviors" such as "tracking the problem to its source and making system changes to prevent recurrence". Iyengar (2023) examines why a systematic problem-solving is the key to innovation. She presents a solution-generation process to innovate, considering out-of-the-box thinking that involves an in-depth examination of current beliefs and even feelings that should be part of any systematic problem-solving process. She argues that a systematic and critical approach to problem-solving is vital to generating "an idea that's different from the ideas that already exist" (Iyengar, 2023, p. 192). We argue that DLL can generate what Grandori (2020, p. 495) indicates as "the imagination of the new in response to the unimagined" because of its potential to make individuals to think "outside the box" (Al-Raqadi et al., 2016; Aminoff & Pihlajamaa, 2020; Bohanec et al., 2017; Foldy & Douglas Creed, 1999).

Method

To address our research question, we conducted a systematic literature review (SLR) on DLL, following the systematic review scheme of Vilariño del Castillo & Lopez-Zafra (2022). We also considered the study developed by Rojon et al. (2021), who conducted a SLR of systematic reviews published in management research, providing a best-practice guide for SLR, and the studies by Williams et al. (2021), who re-examined SLRs in management research and presented a SLR execution guideline, and Morley (2021), who provide key practices for the review process and crafting the review.

To carry out our SLR, we searched for all studies that included in the title and abstract the keywords "double loop" or "double-loop" in combination with "learning". We searched in two databases (Business Source Complete [EBSCO] and Web of Science [WoS]). These are among the most frequently used and biggest open access databases (Okoli, 2015), providing an adequate number of publications for systematic reviews (Creevey et al., 2022). We selected these two major databases to guarantee an extensive coverage of English-language peer-reviewed journals with an impact factor, which are known to be the most important publications in the relevant field (Kühnen & Hahn, 2017).

An initial search of the keywords resulted in 880 studies from 1974 through 2021, excluding articles or books written by Argyris and/or Schön (491 from EBSCO and 389 from WoS). We selected 1974 as the starting year for our search, as it is the year of publication of Argyris & Schön's work related to their theoretical framework about professional learning. A first scrutiny of the studies led to the elimination of duplicate studies, reducing the number to 778. Then six non-English studies were excluded, and we also omitted 102 conference papers and nine periodicals because their research rigor is inferior to journals and might not be subject to traditional peer review processes (Adams et al., 2017; Levy & Ellis, 2006; Talaoui & Kohtamäki, 2021; Webster & Watson, 2002). This screening reduced the number of studies to 661. We screened the 661 studies to review titles, abstracts, and methodology section to identify articles not related to the scope of the review. Most exclusions came from 338 studies that are not related to DLL since they refer to double-loop algorithms, control, network, or strategy in the contexts of machine learning, system learning, automation, or optimization. We have further adopted a quality appraisal of the included papers, excluding 10 articles from journals that are not included in the SCImago Journal Rank 2020, which is not uncommon in SLRs to ensure sufficient quality of the contributions (Rojon et al., 2021). As we explained in our motivation, the focal point of this study is to address issues related to the conceptualization and implementation of DLL in organizational contexts, therefore, our inclusion criteria considered were as follows: (a) we include studies (theoretical, conceptual, or empirical) focused on the analysis of the conceptualization and implementation of DLL in organizations, (b) we include studies that discuss DLL in all types of organizations, for example, local governments, public, or private organizations, and (c) we consider DLL from an organizational member perspective, at the individual, group, and organizational levels. Consequently, we excluded 143 articles that discuss DLL (a) in educational settings adopting a student perspective, (b) adopting a stakeholder, customer, community, or patient perspective, or (c) as a research methodology related to interactive DLL research process between scholars and practitioners. We then excluded 49 studies that mention DLL only as a minor concept. Finally, we added seven studies resulting from a backward search by reviewing the reference lists in our final set of papers to identify any work that our databases search might not have revealed. Our screening process, summarized in Figure 2, resulted in a final sample of 128 studies (including a book) that were fully read.

Almost 90% of the studies were published after 2000, and more than 50% of the articles have been published since 2010 suggesting that the debate on DLL base has grown in recent years. Overall, more than 65% of the references are empirical studies, of which the majority are qualitative. We found articles in 91 different journals reflecting the range of different academic fields that address the topic of DLL. The first four journals per

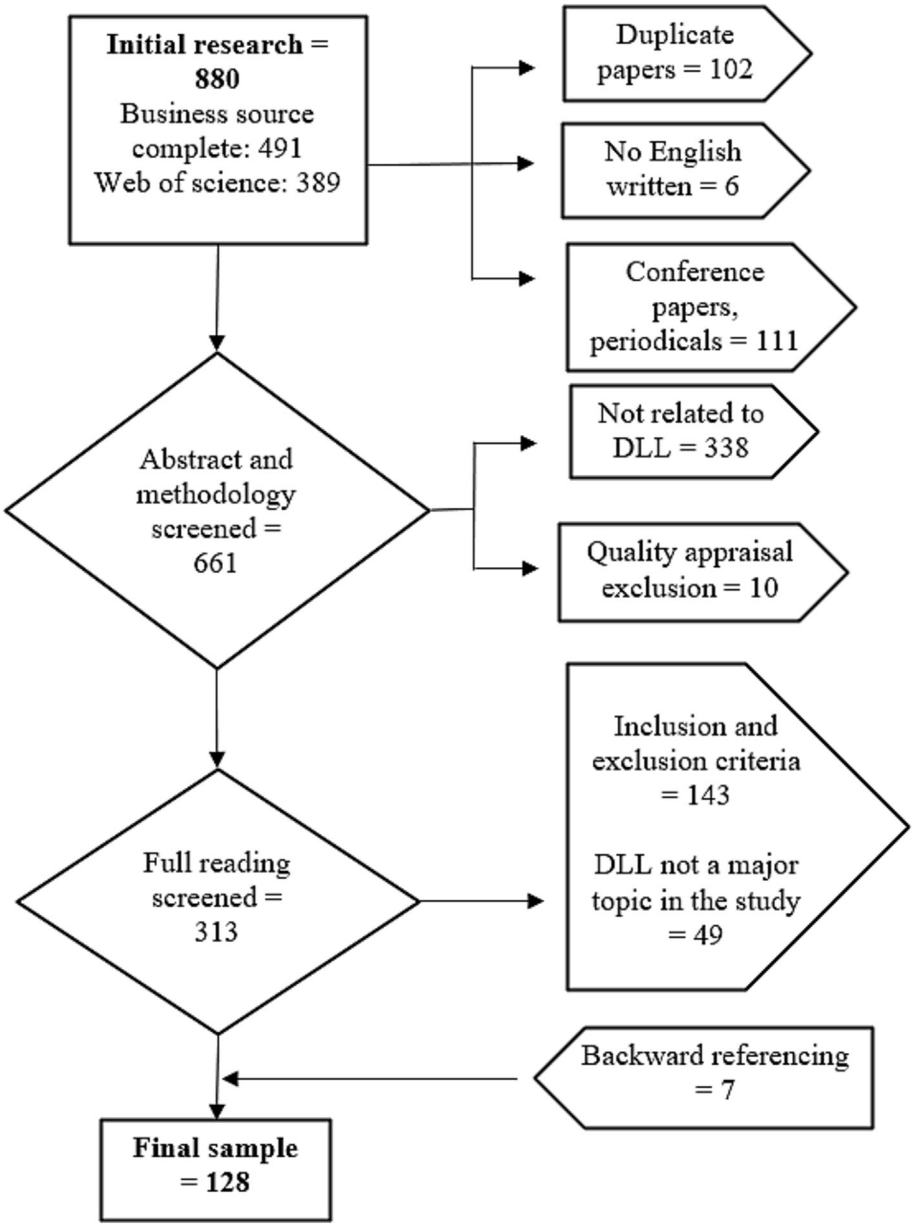

FIGURE 2 Selection process of studies.

number of articles are the following: Learning Organization (11 articles), International Journal of Project Management (five articles), Management Learning (four articles), and Journal of Applied Behavioral Science (four articles). See Supporting Information for details on the journals, their number of articles published per year, and their corresponding journal rank.

We conducted our research following a manual thematic analysis procedure with three stages of interactive cycles. This iterative approach refers to an interplay between data collection and analysis (Kennedy, 2018). As explained above, this study seeks to detect possible misunderstandings or wrong assumptions related to the conceptualization and implementation of DLL. Thus, in the first stage, we focused our attention on finding issues related to the conceptualization and implementation of the notion of DLL. After a first assessment of the content (abstract and methodologies) of the studies, we assigned initial codes to the data, and then organized then into two themes: conceptualization issues and implementation issues. We interpreted our initial data and compared it with the theoretical framework.

After a thorough reading of the reviewed studies, we conducted an iterative process of moving back and forth between our data, the literature, and the initial two themes. As a result of this iterative process, we split the theme of DLL implementation into two different topics: measuring and generating DLL. We considered that this further classification provides a better and clearer insight into implementation issues related to DLL. Consequently, three final themes emerged from our review: conceptualization of DLL, measurement of DLL, and generation of DLL. We used these three themes to organize the studies into three categories: (a) Category A:

how to conceptualize DLL (studies of this category predominantly attempt to provide theoretical contributions to the conceptualization of DLL), (b) Category B: how to measure DLL (studies of this category mainly attempt to provide different methods or tools to assess or measure DLL), and (c) Category C: how to generate DLL (studies of this category include empirical or conceptual articles that primarily provide models, methodologies, or mechanisms focused on overcoming the difficulties and obstacles to generate DLL). Although some studies covered contents belonging to two or all three categories, we assigned each study to just one category based on its major contribution.

In the last stage, we repeated the iterative process within each category to find recurrent sub-themes and consolidating them into emergent groups within each category. The final distribution of the articles for each category is as follows: Category A includes 24 articles distributed in three groups, Category B includes 45 articles distributed in four groups, and Category C includes 59 articles distributed in six groups. The review and coding scheme for each article included in the analytical categories is provided in Table 2. For additional information see Supporting Information.

FINDINGS

Category A: how to conceptualize DLL?

Argyris & Schön provide a "straightforward definition" of DLL (Lipshitz, 2000: 472). DLL occurs when errors are corrected by first examining and changing the governing variables and then the actions. Thus, we can identify two explicit components in the conceptualization of DLL: (a) the cognitive component (change in the values, beliefs, or assumptions governing one's theory-in-use) and (b) the behavioral component (concrete and observable changes in actions or activities).

Following this definition of DLL, we divided the studies that fall into Category A into three groups: (a) Group 1 (14 articles): DLL involves cognitive and behavioral changes, (b) Group 2 (eight articles): DLL involves only cognitive changes, and (c) Group 3 (two articles): DLL involves only behavioral changes. To clarify our findings, Table 3 summarizes the groups of reviewed articles. For more details, see Supporting Information.

The first group (14 articles) relies on a conceptualization linked to the original notion of DLL defining DLL as inclusive of both cognitive and behavioral changes. The definitions adopted by these studies imply first changing governing values, theory-in-use, or taken-for-granted assumptions that ultimately lead to changes in behaviors, actions, routines, practices, or policies.

The second group (eight articles) follows a conceptualization of DLL that involves only the cognitive component. For example, Hammond (2013, p. 1399) indicates that DLL involves "questioning values, assumptions, and belief systems, and worldviews underlying expressed goals", and Phan & Peridis (2000, p. 207) argue that DLL occurs when individuals re-assess "the values that lead to the assumptions underlying the creation of the goals and actions". This conceptualization of DLL only as a cognitive phenomenon is partial and might lead to potential confusion.

As Argyris & Schön (1996) clearly emphasize, most of the time there is a mismatch between espoused theory of action and theory-in-use; thus, it appears inappropriate for scholars to claim that the final outcomes of DLL are changes in governing variables, mental models or paradigms, because the only way to know if one has learned something is "when you can produce in the form of action whatever you claim that you know" (Argyris, 2003, p. 1179). Consequently, DLL occurs when a behavior or action is produced as a result of the changing in governing variables.

The third group (two articles) focuses only on the behavioral component of DLL. For example, Sisaye & Birnberg (2014, p. 8) claim that DLL occurs when an organization modifies "existing operational activities". These articles employ a definition of DLL that is not consistent with the original conceptualization of DLL. They inquire about changing activities, procedures, or operational systems without studying whether these actions are

TABLE 2 Phases of the research study.

Stages of interactive cycles of analysis		
First	**Second**	**Third**
Analytical themes	***Analytical themes and categories***	***Categories and groups***
1. Conceptualization issues	1. Conceptualization of DLL → Category A: How to conceptualize DLL	1. Category A: How to conceptualize DLL (24 articles distributed in three groups)
2. Implementation issues	2. Measurement of DLL → Category B: How to measure DLL	2. Category B: How to measure DLL (45 articles distributed in four groups)
	3. Generation of DLL → Category C: How to generate DLL	3. Category C: How to generate DLL (59 articles distributed in six groups)

Abbreviation: DLL, double-loop learning.

TABLE 3 Category A: studies that provide theoretical contributions to the conceptualization of DLL.

	Number of studies	Percentage of studies	DLL involves mainly
Group			
Group 1: DLL involves cognitive and behavioral changes	14	58%	Questioning and/or changing: • values • assumptions • governing variables and ultimately lead to change: • actions and/or behaviors • practices and/or norms • routines
Group 2: DLL involves only cognitive changes	8	34%	Questioning and/or changing: • values • assumptions • governing variables and ultimately lead to change: • mental models • paradigms • frame of references
Group 3: DLL involves only behavioral changes	2	8%	Questioning and/or changing: • the management system • operating activities and ultimately lead to change: • new ways of doing things • behaviors
Total	***24***	***100%***	
Level of analysis			
Organizational level	8	34%	
Individual, group, and organizational level	7	29%	
Individual and organizational level	4	17%	
Individual and group level	2	8%	
Individual level	1	4%	
Individual, organizational, and industrial level	1	4%	
Individual, organizational, and societal level	1	4%	
Total	***24***	***100%***	

Abbreviation: DLL, double-loop learning.

produced as a result of changes in the underlying governing variables. The conceptualization of DLL only as a behavioral phenomenon is a misconception of DLL.

Category B: how to measure DLL?

The second category of studies focuses primarily on empirical methods of detecting and measuring DLL. Although the methods employed to measure DLL should derive from a clear conceptual definition of DLL, virtually all studies in this group do not explicitly discuss the links between the measurement approach (and/or the items or dimensions they employ) and the conceptualization of DLL. We divided this category into four groups: (a) Group 1 (19 articles): evidence of DLL primarily related to changes in the way individuals or organizations carry out activities, (b) Group 2 (13 articles): evidence of DLL primarily related to cognitive changes, (c) Group 3 (three articles): evidence of DLL primarily related to better problem-solving processes, and (d) Group 4 (10 articles): evidence of DLL primarily related to better root cause analysis. To clarify our findings, Table 4 summarizes the groups of reviewed articles. For more details, see Supporting Information.

In the first group (19 articles), studies attempt to measure DLL outcomes primarily as changes in the way individuals or organizations do things. The measurements adopted aim to capture the behavioral component of DLL. Studies of this group are based predominantly on questionnaires, interviews, or text data content. We identified only one study that uses observations as a complementary data source to collect evidence of DLL. Nearly all studies that exclusively employ surveys ask

TABLE 4 Category B: studies that provide methods or tools to assess or measure DLL outcomes.

	Number of studies	Percentage of studies		Number of studies	Percentage of studies
Group			**Data source (evidence of DLL)**		
Group 1: evidence of DLL primarily related to changes in the way individuals or organizations carry out activities	19	42%	Survey (only)	24	53%
Group 2: evidence of DLL primarily related to cognitive changes (mental models, beliefs, values, assumptions, or theory-in-use)	13	29%	Interviews (only)	8	18%
Group 3: evidence of DLL primarily related to better problem-solving processes	3	7%	Observations + surveys/ interviews	5	11%
Group 4: evidence of DLL primarily related to better root cause analysis	10	22%	Internal reports + interviews	4	9%
			Reports or text data (only)	4	9%
Total	***45***	***100%***	***Total***	***45***	***100%***
Level of analysis					
Organizational level	32	71%			
Individual level	5	11%			
Group level	2	4,5%			
Individual, group, and organizational level	2	4,5%			
Individual, organizational, and industrial/societal level	2	4,5%			
Individual and group level	1	2,25%			
Group and organizational level	1	2,25%			
Total	***45***	***100%***			

Abbreviation: DLL, double-loop learning.

respondents for general perceptions or opinions about the learning environment or learning changes. In a few instances, text data content analysis is used to measure DLL. For example, Reddick et al. (2017) employ the "Social Media Text Analytics Methodology" to assess online citizen-to-government interactions on the Facebook page of a local government department to find evidence of DLL. Hence, Reddick et al. (2017) suggest that evidence can be found in text data produced by interactions between government and citizens because citizens' feedback can directly shape public policies. We argue that looking only at text data produced on different supports (paper, files, social media platforms) is not appropriate for measuring DLL outcomes, as it cannot illustrate the behavioral or cognitive component of DLL whether at individual, group, or organizational level. In addition to the method used to measure DLL, there are also divergent views on the behavioral dimensions to be considered to get evidence of DLL. Some scholars use one-dimensional measures focused on new ways of working or new procedures (Sitar et al., 2018) or focused on new ideas or working practices (Chaston et al., 1999, 2000, 2001; Chaston & Scott, 2012). Other scholars use multidimensional measures. For example, Simonin (2017) employs two dimensions related to collaborative forms and collaborative modes. Al-Raqadi et al. (2016, 2017) and Al-Raqadi (2019) use three dimensions linked to proficiency, efficiency, and concentration, and Jashapara (2003) employs five dimensions related to proficiency, efficiency, concentration, innovation, and direction.

The second group (13 articles) assesses DLL outcomes as changes in mental models, beliefs, values, assumptions, or espoused theories. Contrary to the first group, these studies aim to capture changes related to the cognitive component of DLL. Twelve studies are based primarily on questionnaires or interviews. Surveys ask participants for their general opinions about learning outcomes. We identify only one article where the authors employ an action research intervention, using observations as the main data source to collect evidence on DLL. This study, conducted by Mitchell et al. (2012), examines whether a Triple Bottom Line (TBL) sustainability reporting process in a company leads to DLL, that is, changing in assumptions, values, or even the mission of the firm. They use the following criteria to encode possible outcomes of DLL: (a) if the espoused theory (the assumptions, values or mission that underpinned organization activities) are changed and (b) if there is a systematic questioning and re-evaluation of organizational goals. The authors find little evidence of DLL.

In the third group (three articles), researchers attempt to measure DLL by tracking changes related to problem-solving processes. This group can be considered a subgroup of Group 1 since it considers a particular behavioral change in the form of adopted problem-solving practices. We decided to single out these studies because of their focus on the problem-solving process, a central element of OL (Furlan et al., 2019). The three studies employ different methods to get evidence of DLL (audio diary record, interviews, reports). Some confusion might arise from the fact that these studies tend to equate DLL to a better (or more effective) problem-solving process. Increasing the effectiveness of problem solving can be considered a way to generate DLL (category C of our literature review) rather than a measure of DLL.

The fourth group (10 articles) assesses the outcomes of DLL as changes related to a better root cause analysis. This group is strictly related to the previous group with a specific focal point, that is, the analysis of the root cause of a problem, arguably the most important aspect of the systematic problem-solving process (Furlan et al., 2019). As in the previous group, studies of this group can lead to confusion regarding what it is measured. In fact, these studies track behavioral changes (i.e., root cause analysis practices) that can be interpreted as a way (inquiry and reflective practices) to generate DLL (category C of our literature review) rather than a measure of DLL.

Overall, from our review of this category it emerges that there is no consensus on how to detect and measure the outcomes of DLL. The lack of practical and validated tools and approaches to assess the results of DLL reflects the misunderstanding behind the fundamental notions of DLL and also leads to confusion for researchers and practitioners about the information that can provide appropriate evidence of DLL in organizational settings. Argyris & Schön developed methods and tools based predominantly on directly observable data to identify the theory-in-use of participants and to show the transition from Model I to Model II theory-in-use. As Argyris (1991, p. 7) argues, if you "ask people in an interview or questionnaire" what the governing variables (i.e., values, beliefs, or assumptions) they use to design their actions, they will give you "their espoused theory of action". But if you "observe these same people's behavior, you will quickly see that this espoused theory has very little to do with how they actually behave". The reason why human beings act inconsistently with what they preach is that they are "unaware of the contradiction between their espoused theory and their theory-in-use, between the way they think they are acting and the way they really act" (Argyris, 1999, p. 131). Some researchers stress the awareness that surveys, interviews, mere conversations, or other similar approaches are unsuitable to identify the differences between theory-in-use and espoused theory, since theory-in-use and their governing variables must be inferred from actual behaviors or routines of individuals, teams, and organizations (Cope, 2003; Mazutis & Slawinski, 2008; McAvoy & Butler, 2007). However, our review reveals that 90% of the 45 reviewed studies of category B are based primarily on questionnaires, interviews, reports, or text data content. Over 50% of the identified studies exclusively use survey (questionnaires) as a unique data source to collect evidence on DLL.

Category C: how to generate DLL?

Category C comprises 59 studies, which intend to provide models, methodologies, or mechanisms that address difficulties, barriers, or enablers to develop DLL. About 70% of the identified studies are qualitative. We grouped studies of category C into six groups: (a) Group 1 (17 articles): the lack of leaders committed to reflection and dialogue is the major barrier to producing DLL, (b) Group 2 (14 articles): continuous improvement practices are useful enablers of DLL, (c) Group 3 (nine articles): technological tools or mechanisms can trigger DLL, (d) Group 4 (six articles): organizational designs and operating contexts can create the conditions to generate DLL, (e) Group 5 (six articles): lesson-learned reports can produce key insights that support the generation of DLL, and (f) Group 6 (seven articles): other individual or organizational mechanisms that can support DLL. Table 5 provides examples of proposals to produce DLL provided by some reviewed articles. For more details, see Supporting Information.

Group 1 (17 articles) contains studies that maintain that leaders engaged in critical reflections or authentic dialogue about assumptions underlying taken-for-granted procedures or practices are necessary enablers of DLL. Three intervention studies of this group stand out, based primarily on data collected through observations. Hardless et al. (2005) investigate the role of PIER (Problem-based learning, Interactive multimedia, Experiential learning, and Role-playing), whose purpose was to facilitate experience sharing, discussion, and critical reflection to produce DLL. The authors examine whether participants in PIER activities re-examine and shift their personal governing variables underlying existing project management practices. Unfortunately, the real impact on new improvement actions was very limited and did not involve changes in crucial areas of performance (i.e., PIER did not lead to DLL). The authors argue that, to produce DLL, the intervention should have involved individuals in key positions (leaders) who held the power to stimulate, drive, and facilitate significant organizational changes. Vashdi et al. (2007) examine the applicability of briefing-debriefing sessions, a team-based learning model used in the Israel Air Force (IAF), to hospital surgical teams to promote DLL. According to the IAF model, the briefing-debriefing protocol aims to encourage both episode-specific error detection and correction (SLL) and the examination of the assumptions embedded in the system that led to errors to one or more missions (DLL). The authors tweak the briefing-debriefing sessions to consider issues specific to surgical contexts. Researchers conclude that the type of learning developed by participants in these

TABLE 5 Category C: studies that provide models, methodologies, or mechanisms focused on overcoming the difficulties and obstacles to generate DLL.

	Number of studies	Percentage of studies	Proposals to generate DLL (some examples)
Group			
Group 1: major barrier to producing DLL is the lack of leaders committed to reflection and dialogue	17	29%	• PIER: Problem-based learning, Interactive multimedia, Experiential learning, and Role-playing (Hardless et al., 2005) • Briefing-debriefing sessions, a team-based learning model being used in the Israeli Air Force (Vashdi et al., 2007) • Double-loop coaching (DLC) mechanism based on a "3R" continuous cycle of practices: reflect, reframe, and redesign (Witherspoon, 2014) • Collaborative Developmental Action Inquiry (CDAI) method (Kwon & Nicolaides, 2017)
Group 2: Continuous improvement practices are useful enablers of DLL	14	24%	• Plan-Do-Check-Act cycle can generate five types of improvement behavior related to SLL and DLL (Mazur et al., 2012) • Integrated Double Kaizen Loop (IDKL) model that combines DLL with Kaizen (Al-Baik & Miller, 2019) • DMAIC-DLL framework that integrates DMAIC (Define, Measure, Analyse, Improve and Control) with DLL (Kolawole et al., 2021)
Group 3: technological tools or mechanisms can trigger DLL	9	15%	• Simulations for reengineering (Tsuchiya, 1998) • Simulation models for management decisions (Kim et al., 2013) • Machine learning model using an IT artifact (supporting decision-making in B2B sales forecasting) (Bohanec et al., 2017)
Group 4: organizational designs and operating contexts create the conditions to generate DLL	6	10%	• Circular design (Romme & Van Witteloostuijin, 1999) • Innovation laboratory design (Lewis & Moultrie, 2005) • Organic design (Sitar & Škerlava, 2018)
Group 5: lessons-learned reports produce key insights that support the generation of DLL	6	10%	• Incident-reporting systems (Stavropoulou et al., 2015) • Lessons from crisis reports (Deverell, 2009)
Group 6: other individual or organizational features that support DLL	7	12%	• Intervention model that incorporates the Theory of Immunity and the Theory of Action (Bochman & Kroth, 2010) • A model based on the original ideas of the 4I model (Crossan et al., 1999) to produce OL: intuition, interpreting, integration, and institution.
Total	***59***	***100%***	

Level of analysis			**Study design**		
Organizational level	29	49%	Empirical	41	70%
Individual and group level	9	15%	Conceptual	16	27%
Individual, group, and organizational level	6	10%	SLR	2	3%
Individual and organizational level	5	9%			
Individual level	4	7%			
Group level	4	7%			
Group and organizational level	2	3%			
Total	***59***	***100%***	***Total***	***59***	***100%***

Abbreviations: DLL, double-loop learning; SLR, systematic literature review.

sessions was largely SLL. The authors maintain that one of the main barriers to the implementation of this model was that the communication protocol did not require communicating with the executive layer unless required by the protocol or specifically requested by those with higher status. Witherspoon (2014) suggests that double-loop coaching (DLC) based on a "3R" continuous cycle of practices (reflect, reframe, and redesign) may help leaders learn. "The essence of DLC is the idea that the way leaders act and the results they create begin with the way they think" (Witherspoon, 2014, p. 261). The author claims that the DLC process is designed to coach on the actions and thinking of leaders (not just their overt behavior), and it requires leaders to reflect critically on their thinking (based on in-depth listening and dialogue), assess their reactions and their frame of reference (which may inadvertently contribute to problems), and then consider change. Witherspoon finds that DLC helps leaders use their reflections as a springboard for reframing how they think and act in key situations, facilitating DLL. Overall, from this group of studies we derive that the lack of commitment of leaders and key employees who are not open to inquiry and authentic dialogue inhibit the generation of DLL.

Studies in Group 2 (14 articles) link DLL with continuous improvement tools. Studies in this group argue that the implementation of continuous improvement tools or methods can trigger a process that might ultimately produce DLL. Kolawole et al. (2021), for instance, propose a five-stage "DMAIC-DLL" framework to achieve DLL that integrates DMAIC (Define, Measure, Analyse, Improve and Control) with the DLL approach. They claim that these five stages may generate DLL because at each stage collaborative and experiential learning is promoted. Al-Baik & Miller (2019) propose the "Integrated Double Kaizen Loop (IDKL)" model that combines OL methods with Kaizen (the Japanese continuous improvement philosophy). They argue that IDKL tools and methods (e.g., 5 whys) help companies to develop a culture of small improvements as a daily habit, and this allows sustainable and noticeable improvements over the long term. Mazur et al. (2012) find that the Plan-Do-Check-Act cycle can generate three types of improvement behaviors related to SLL (Quick Fixing, Conforming, and Expediting behaviors) and two types related to DLL (Initiating and Enhancing behaviors). They observe that out of a total of 504 instances of improvement behaviors, only 26 times the employees engaged in DLL behaviors. Finally, Stålberg & Fundin (2018) state that the degree of maturity of a company in continuous improvement tools is related to the extent to which it adopts DLL. They find that having a high maturity level on lean production lead to higher DLL.

Studies in Group 3 (nine articles) propose that technological tools may have the potential to generate DLL. These studies attempt to facilitate DLL by exploring the potential of technological models to improve human capabilities to change their mental models or beliefs. Kim et al. (2013) claim that simulation models may enhance DLL, because in the process of building and running a simulation model, the management team merges an interpretivist approach of their mental models with a positivist approach supported by empirical data to support their management decision. They find that the modelling process initiates two types of DLL in management teams. The first occurs when full system maps are created to build and explore mental models. The second occurs when simulation models are created to enhance the accuracy of mental models. Bohanec et al. (2017) propose a machine learning model using an IT artifact (supporting decision-making in B2B sales forecasting) to develop and formalize DLL. They conclude that DLL was produced when the participants analysed the learning model, tested their beliefs, and experimented with different scenarios.

Studies in Group 4 (six articles) maintain that organizational designs and operating contexts are particularly significant in facilitating DLL. Romme & Van Witteloostuijin (1999) propose a new organizational design, "the circular organization". They argue that the following precepts of circular organizing appear to provide a structural facilitation of DLL: (a) organizing into circles, while retaining the hierarchical structure for managing the workplace, (b) decision making is governed by consent, which facilitates public debate and free inquiry, (c) double linking between circles, which promotes both upward and downward communication, and (d) election of team member in each circle is done by consent after open and free discussion. The authors suggest that the circular design tends to support and promote processes of open and free inquiry in each circle, and this would lead to changes in polices, objectives, and mental maps. Lewis & Moultrie (2005) propose a framework that investigates the benefits of the organizational design known as "innovation laboratory" for the production of DLL. Innovation laboratories are dedicated facilities or workspaces designed to encourage creative behaviors and innovative solutions. They argue that an innovation laboratory provides a set of resources that are dynamically reconfigured based on the issue under consideration, "thereby enabling an organization to create and enhance organizational routines by which managers can adapt their resource base to generate new value-creating strategies" (Lewis & Moultrie, 2005, p. 75) which ultimately lead to DLL.

The studies of Group 5 (six articles) link DLL with lessons-learned reports, which are organizational reports used to share lessons learned or best practices from incident or project reports. Within this group, the work of Stavropoulou et al. (2015) is worth mentioning. They conducted a SLR to examine the effectiveness of incident reporting systems (IRS) in facilitating SLL or DLL. They assess whether IRS are effective in improving patient safety in hospital settings. Their review found that the evidence presented by 33 of the 35 examined papers could be classified as SLL, such as direct improvements to clinical settings. There was no strong evidence that IRS enabled DLL associated with a cultural change or a change in mindsets.

Group 6 (seven articles) contains miscellaneous studies that link DLL to a variety of individual or organizational features.

Overall, studies of category C present a wide range of different models, methodologies, and mechanisms focused on overcoming difficulties in generating DLL. Most of these proposals indicate various limitations or barriers that inhibit the production of DLL (emotional, cognitive, social, and organizational barriers). Overall, these studies maintain that the most prominent barrier to generate DLL is defensive reasoning and routines (Bochman & Kroth, 2010; Clarke, 2006; Kwon & Nicolaides, 2017; Sisaye & Birnberg, 2010; Stavropoulou et al., 2015; Sterman, 1994; Wong, 2005), which are produced by participants in DLL processes, whenever assumptions underlying taken-for-granted procedures, practices, or policies are challenged. Although people are aware that they should not use defensive reasoning to deal with daily work difficulties and challenges (Thornhill & Amit, 2003), they still use them to avoid losing control and dealing with embarrassment (Mordaunt, 2006).

As an additional comment, we observe that the level of analysis changes across the three categories. Studies in category A focus their attention on individual, group, and organizational level, while categories B and C focus mostly on the organizational level. This difference lies in the fact that the conceptualization of DLL starts at the individual level (i.e., individual espoused theory and theory-in-use) and then is studied at the group and organizational level, whereas, to measure or generate DLL, most of the reviewed articles use methods or tools designed to be applied at the organizational level. There are no studies that explore the aggregation mechanisms that lead to organizational DLL starting from individual DLL.

To guide the reader toward a better and comprehensive understanding of our review, in Figure 3, we summarize our results emerged from the three categories.

The role of context in generating DLL

An in-depth analysis of the third category of studies on the generation of DLL reveals that interventions are seldom effective in generating DLL. We maintain that one of the reasons for the poor success in generating DLL is that too often the role of the context is neglected in crafting effective interventions. We believe that the theory of Argyris & Schön's does not place too much emphasis on the role of context since the authors are interested in advancing a general theory of organizational behavior. We think that, although the reasons that explain the difficulties and barriers in generating DLL might be universal (i.e., the extensive adoption of Model I theory-in-use and the associated defensive reasoning), one has to carefully consider the context when designing interventions aimed at changing cognition and behaviors.

The recognition of the influence of the context on learning is not new. Tessmer & Richey (1997, p. 85) argue that "the context is a pervasive and potent force in any learning event". They define context as "a multilevel body of factors in which learning and performance are embedded" (Tessmer & Richey, 1997, p. 87). Johns (2006, p. 386) define context as "situational opportunities and constraints that affect the occurrence and meaning of organizational behavior". Individuals can choose to ignore the context, but nobody can choose to be separated from or avoid it (Bonnes & Secchiaroli, 1995; Greeno, 1989). Recently, some scholars have revealed the lack of clarity about explicit sets of contextual factors that might shape individuals' behavior in learning interventions (Cai et al., 2019; Johns, 2018). Therefore, we posit that the incorporation of a contextual approach to DLL interventions may improve their learning outcomes. We follow the concept of discrete context, provided by Johns (2006, p. 393), defined as "specific situational variables that influence behavior directly" that includes three salient dimensions "task context, social context, and physical context".

By analyzing studies of Category C that are based primarily on observable data, we singled out a list of contextual factors that may impact the generation of DLL. This list is intended to provide initial insights for future research to deep our understanding of how incorporating contextual features might help in crafting effective DLL interventions.

As for task contextual factors, we identified a set of three features as particularly important. First, time associated to the generation of DLL. DLL does not occur overnight and managers should carefully manage the time needed to generate DLL. DLL interventions are time-consuming and require participation in multiple reflection and inquiry sessions, with interventions lasting from 18 to 24 months, since learning in a double-loop mode requires repetition and practices that usually take time, sometimes a long time (Hardless et al., 2005; Huang & Shih, 2011;Vashdi et al., 2007; Witherspoon, 2014). Second, the complexity of the tasks. Complex tasks are often associated to more uncertainty and the results of DLL are often less than desired hampering the acceptance of change (Hardless et al., 2005; Vashdi et al., 2007; Witherspoon, 2014). Third, performance management systems. Learning interventions must involve the design and adoption of new, periodic and observable outcomes to measure performance improvement, that is, they must provide participants with a clear and concrete picture of cognitive and behavioral changes, preventing them from losing confidence or faith in learning programs. (Hardless et al., 2005; Huang & Shih, 2011).

Also, for social contextual factors, we identified three factors. First, collective reflections. Collective and rigorous reflections and inquiries are necessary social conditions to generate DLL. Collective reflections are aimed at deeply understanding discrepancies between actual and desired performance and testing and inspecting taken-for-granted assumptions, beliefs, and values (Hardless et al., 2005; Huang & Shih, 2011; Vashdi et al., 2007; Witherspoon, 2014). Second, psychologically safe contexts promote authentic dialogue. DLL requires

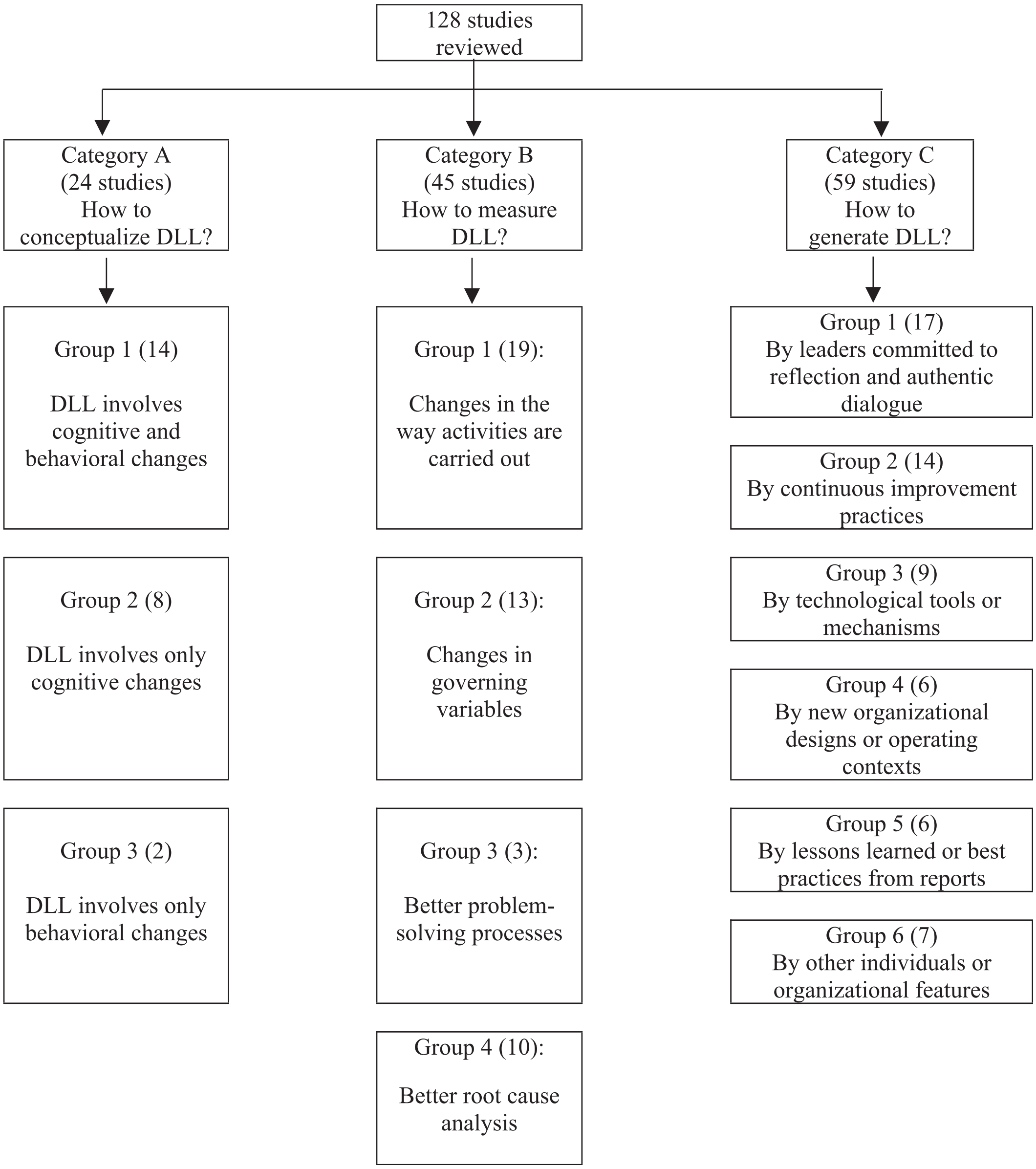

FIGURE 3 Results from the three categories.

participants to engage in authentic dialogue in which all individuals are encouraged to openly and honestly express their opinions and concerns (Vashdi et al., 2007; Witherspoon, 2014). Third, involvement of leaders. As previously noted, DLL generation requires participation and commitment of key leaders who hold the power to promote organizational change and influence the behavior of others (Hardless et al., 2005; Huang & Shih, 2011; Vashdi et al., 2007; Witherspoon, 2014).

Finally, for the physical context, some studies emphasize the need for physical space to have group meetings as an important characteristic of contexts conducive to DLL. Participants need to be brought together in a single room and have face-to-face communication to share information and feelings. Indeed, as Hardless et al. (2005, p. 205) argue, opportunities for reflection require "a meeting place for discussion with colleagues" and leaders are usually "required to get together in meetings" to change values and assumptions to make decisions (Huang & Shih, 2011, p. 631). Recently, virtual workplace is becoming relevant in several organizations (Stoker et al., 2022). A virtual workplace is a workplace that is not located in a physical space (Zemliansky & St. Amant, 2008). Words like "work from home", "telework" and "remote work" start making buzzwords in organizational settings (Raj et al., 2023). However, working without face-to-face contact "can lead to difficulties in establishing a sense of collective identity and can inhibit effective communication among team members" (Kimble, 2011, p. 12) and "virtual teamwork can experience a lack of trust and shared understanding among the team members" (Pinjani & Palvia, 2013, p. 145).

Therefore, these limitations may inhibit the generation of DLL where open and honest communication and inquiry are vital. These limitations notwithstanding, the use of appropriate communication technologies might curb these limitations, by improving the flow of knowledge (Zemliansky & St. Amant, 2008) and communicating frequently (Raj et al., 2023).

REVITALIZING DLL: A FRAMEWORK AND A RESEARCH AGENDA

Based on our SLR, we propose a framework that makes explicit the misconceptions, wrong assumptions, and barriers in conceptualizing, measuring, and generating DLL (Figure 4).

The framework also proposes several ways to overcome these limitations and serves as a platform for future research on DLL. Finally, the framework, integrates contextual factors (task, social, and physical) into DLL generation with the aim of improving the effectiveness of DLL interventions.

First, we uncover misconceptions surrounding the definition of DLL. Some scholars interpret DLL only from the behavioral standpoint while other only from the cognitive standpoint. As indicated in our framework, DLL should be understood as a learning process that involves both cognitive changes (shifts of values, beliefs, or assumptions that govern one's theory-in-use) and behavioral changes (concrete and observable changes in actions or activities). To produce sustainable changes in behaviors, it is necessary to learn a new set of governing variables, that is, new models or mental frameworks, that allow the actors to move from model I to model II theory-in-use.

This study also highlights some wrong assumptions unwittingly made by researchers and practitioners in measuring DLL. The review of the second theme revealed that most researchers focus their attention on the collection of primarily behavior changes as evidence of DLL, which reflect the misunderstanding behind the notion of DLL. The wrong assumption is that it is enough to collect evidence on actors' behaviors to derive conclusions about the existence of DLL. For example, it is inappropriate to argue that there is evidence of DLL when a team or organization moves away from firefighting mode to root cause analysis, without any evidence that this shift is associated with changes in the governing variables. If there is no change in behaviors or actions because of the change in the governing variables, there is no DLL. As stated in our framework, DLL's measurement should involve collecting evidence related to cognitive changes that ultimately become behavioral changes.

Wrong assumptions in measuring DLL lead to errors in the methods used to collect information. Most of the reviewed empirical studies aimed at measuring DLL present their findings based exclusively on questionnaires or interviews. Nevertheless, without observable (low-level) data, it is impossible to understand, determine, and detect the individuals' theory-in-use. Therefore, we claim that empirical evidence on DLL obtained primarily or solely through questionnaires or interviews violates Argyris & Schön's fundamental methodological teachings based on analysis of observable data.

From our last category, we identify a set of barriers that make the generation of DLL a challenging endeavour. The analyzed papers identify various limitations or barriers that inhibit the production of DLL, confirming what scholars indicate about the challenges and complex process required to develop DLL (Bochman & Kroth, 2010; Henderson, 1997; Lipshitz, 2000; Tsuchiya, 1998). Defensive reasoning or behaviors were identified as the main barrier to producing DLL. Finally, our framework makes the role of context (task, social and physical) explicit in generating DLL.

Overall, our framework highlights that DLL could be more consistent, predictive, and operationalizable if our recommendations on how to conceptualize, measure, and generate DLL are followed. This framework also provides a platform for a research agenda that we hope can revitalize the research on DLL. In particular, we call for further research on DLL that:

- genuinely follows the original DLL concepts taking into consideration the fundamental distinction between espoused theories and theory-in-use and considering that DLL should involve the cognitive and behavioral component of a learning process. Only in this way, discussions and analysis of DLL will be theoretically sound.
- rigorously employs the basic methodological requirements developed by Argyris & Schön. Researchers might realize that the analysis and results related to changes in individuals' theory-in-use need to be captured based on data collected primarily through direct observations on agents' behaviors or actions. Studies should devote their effort to conduct in-depth examinations of the process of transition from Model I to Model II theory-in-use, in order to identify feasible measures of DLL.
- provides a comprehensive understanding of defensive reasoning and routines that limit the generation of DLL. Recently, Yang et al. (2018) identified two types of organizational defensive routines, at the individual level, namely embarrassment avoidance and rigidity at work. Although interesting, we maintain that this categorization is incomplete since it misses important aspects of both individual and organizational defensive routines.
- thoroughly explores methods or tools to measure and/or generate DLL. Empirical research on DLL needs to be qualitative, based on direct observations, preferable with an ethnographic approach, and should adopt a multilevel research, since it is critical to

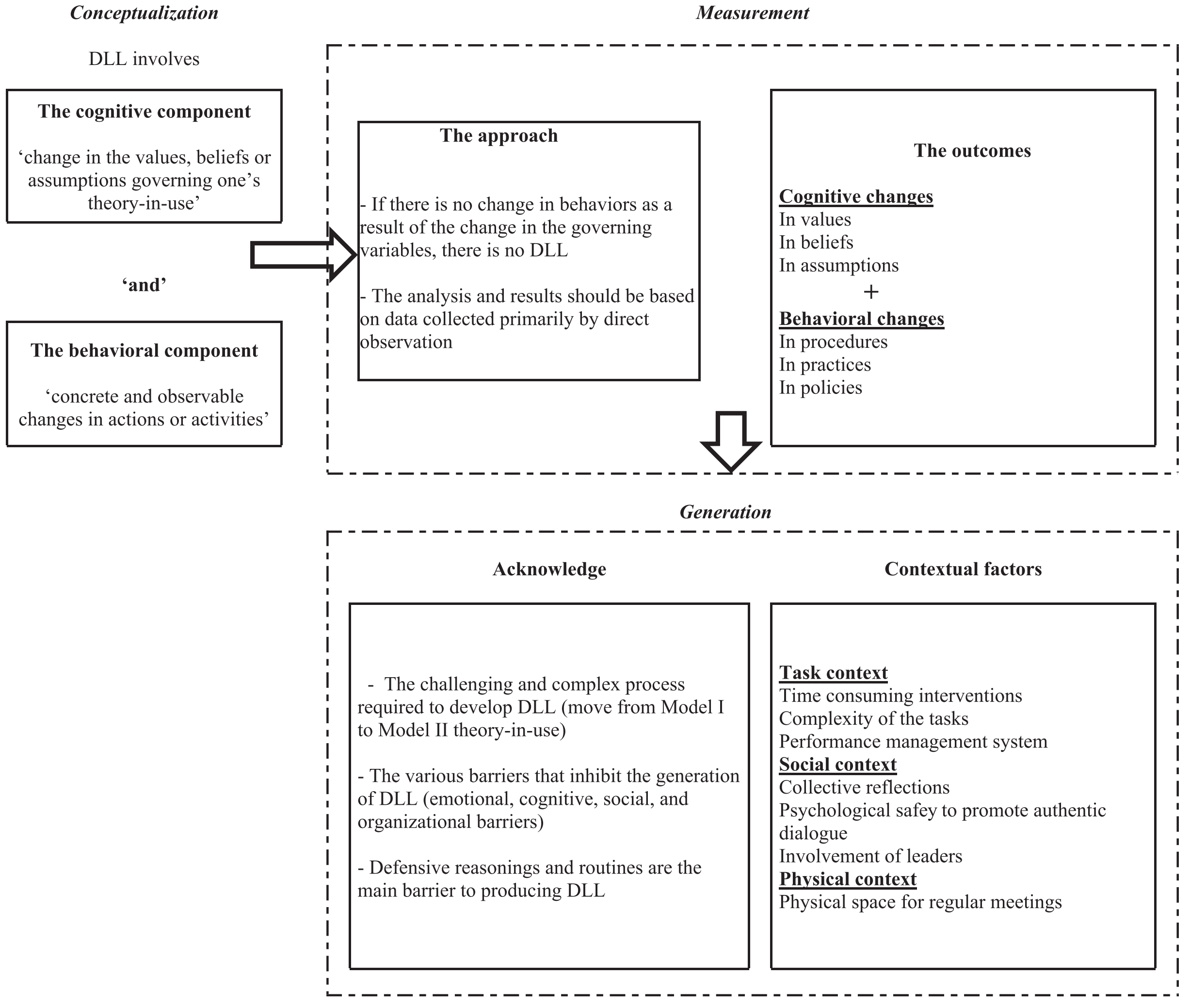

FIGURE 4 An analytical framework for future research on DLL.

understand the aggregation mechanisms that link individual behaviors to the organization's capabilities (Barney & Felin, 2013).
- delves into the role of context in crafting effective DLL interventions. Increasing awareness about the potential critical role of contextual features, such as task, social, and physical, may be a foundational step toward improving the quality of DLL action research.

CONCLUSIONS AND LIMITATIONS

This study aims to establish a breaking point in the conceptual confusion surrounding DLL and in the spread of practical applications on DLL that ignore its original notions. Our study emphasizes that the literature on DLL has not evolved positively as, over time, it has lost its original conceptual foundations and has used unsuitable methodological approaches.

We contribute to the literature by clarifying the conceptualization, measurement, and generation of DLL. In particular, this study highlights that (1) DLL is a learning process that necessarily involves behavioral changes as result of cognitive changes (modification of deeply held values, beliefs, and assumptions), (2) researchers should choose the appropriate research methodology to study DLL, and (3) practitioners have to consider various barriers and challenges before embarking on a DLL research project.

Our SLR may suffer from some limitations. First, even though we use a comprehensive search with broad inclusion criteria, it is possible some relevant studies were still missed that may impact on the overall topics. We attempt to use a validated method to select studies, including using a cross-checked reference list for further potentially relevant papers. Second, we employ a manual and qualitative screening and synthesis rather than text mining or bibliometric analysis of the reviewed studies. The review protocol used to assign the collected references to three categories and to synthesize the interpretation of key findings may be seen as subjective. To reduce a possible subjectivity of review and analysis, we attempt to provide a transparent, rigorous, and holistic overview of existing knowledge related to the target topic by synthesizing existing research. Third, the distribution of articles across the three analytical categories (i.e., DLL conceptualization, DLL measurement, and DLL generation) was based on their relevance and major contribution to each category. Other approaches could have been followed, for example, considering individual papers part of more categories when they dealt with more than one theme.

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CONFLICT OF INTEREST STATEMENT

The authors whose certify that they have NO affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article.

AUTHORS' CONTRIBUTION

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Mercedes Victoria Caceres Auqui. All authors worked on and commented on previous versions of the manuscript. All authors read and approved the final manuscript.

ORCID

Mercedes Victoria Caceres Auqui https://orcid.org/0000-0002-8154-8400
Andrea Furlan https://orcid.org/0000-0001-7931-6419

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AUTHOR BIOGRAPHIES

Mercedes Victoria Caceres Auqui is a post-doctoral researcher at the Department of Economics and Management of the University of Padova, Italy. His research interests include organizational learning, organizational routines, and business strategy.

Andrea Furlan is a full professor of management at the Department of Economics and Management of the University of Padova, Italy. His research interests include microfoundations of organizational learning, systematic problem solving and proactive behaviors, operational excellence, and lean management. He published extensively in a variety of fields such as operations management, organizational behavior, and strategic management.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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