

Original Paper

Mediation through Computerized Dynamic Assessment (C-DA) for Second and Foreign Language Learning: A Literature Review

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Abstract

This paper examines research on the effects and roles of computerized dynamic assessment (C-DA) in mediating second language (L2) learning and development. The review synthesizes studies on C-DA interventions for developing language skills including reading comprehension, vocabulary and grammar skills. C-DA studies indicate the promotion of language development, but the effectiveness is not all attributed to C-DA mediations. Effectiveness seems dependent on both C-DA and additional factors like noticing skills or teacher mediation. In these studies, most C-DA prompts are pre-constructed and not fully attuned to learners' zone of proximal development, and some C-DA studies address this by complementing C-DA with human mediator interaction. Given the limited number of C-DA studies, the findings of this review are limited. More research is needed, especially on integrating human and computer mediation. However, this review offers implications for designing responsive C-DA platforms to better attune to learners' needs.

Keywords

computerized dynamic assessment, mediation, zone of proximal development

1. Introduction

Dynamic Assessment (DA) integrates assessment and instruction to promote learners' language development, and it provides the mediation which is sensitive to the learners' abilities (Lantolf & Poehner, 2007). It "takes into account results of an intervention" during which "the examiner teaches

the examinee how to perform better on individual items or on the test as a whole” (Sternberg & Grigorenko, 2002). It can be indicated that external interventions to learners are introduced in the process of DA. Given its unique view on assessment and instruction, DA has received increasing interests in second and foreign language learning and teaching (Li & Li, 2015). DA is mainly studied in terms of its effectiveness of learners’ language development in language sub-skills, such as listening and reading comprehension, grammar and vocabulary skills. However, most DA practices are conducted one-on-one, which makes it difficult to implement for a language classroom with multiple learners (Poehner, 2009).

As an alternative DA practice to address multiple learners, Computerized Dynamic Assessment (C-DA) is proposed. C-DA is argued to serve multiple learners efficiently and enable frequent re-assessment and automatic generation of learners’ reports, given its technological advantage (Poehner, 2008). However, as a DA practice which may also promote language development, C-DA’s mediation of language learners to develop their language skills has not been comprehensively reviewed. Therefore, this literature review aims to address this research gap and tries to answer the following two research questions:

Question 1: How does C-DA mediate language learning?

Question 2: How effective is C-DA in promoting language development?

2. Theoretical Background

2.1 DA and Vygotsky’s Sociocultural Theory (SCT)

DA is theoretically rooted in Vygotsky’s Sociocultural Theory (SCT). SCT views learning as a social and cognitive process—new knowledge is originated in the process of social interaction and is subsequently internalized into mental schema (Ellis, 2015). In the process of social interaction, mediation—“the process through which humans deploy culturally constructed artifacts..., and activities to regulate...their own and each other’s mental activity” (Lantolf & Thorne, 2006, p. 79)—involves using tools to support learners in order to fulfill the task that they cannot fulfill independently (Ellis, 2015). In this spirit, learning abilities need to take account of the potential learning ability with external help. Zone of Proximal Development (ZPD) delineates a scope of learning abilities ranging from the actual ability of working independently to the potential ability of working with external support. Therefore, in order to fully assess a learner’s ability, external support needs to be offered when learners cannot complete the task independently. While a learner’s scope of abilities is being assessed, the external support provided serves to further promote the learner’s development within his/her ZPD (Poehner, 2008).

Given this view on assessment, the relationship between the examiner and examinee can also be seen as the mediator and learner: The mediator provides support to learners to mediate learners’ development within their ZPDs (Poehner, 2008). Such re-conceptualization of roles as mediator and learner sheds a new light in the language teaching and learning. In this light, teachers can be seen as

mediators who assess and explore learners' problems while offering instructional support to further cultivate learners' potential abilities (Lantolf & Poehner, 2008). And DA exemplifies well this integration of assessment and instruction between a mediator and learner.

2.2 Two DA Models

As previously discussed, mediation needs to be provided to learners when they are not able to fulfill a task independently. However, mediation can be provided in different forms, ranging from relatively fixed, standardized hints to dynamic, dialogic interaction. Lidz and Gindis (2003) stress the importance of distinguishing the different forms of mediation since different kinds of medication should not be viewed as equally effective in mediating learners' development. Vygotsky (1998) was aware of the different mediation approaches and viewed the dynamic mediator-learner interaction that mediates learners' development as cooperative dialoguing.

Based on the different forms of mediation used, Lantolf and Poehner (2004) propose the two general models of DA: interventionist dynamic assessment and interactionist dynamics assessment. Interactionist DA resembles Vygotsky's cooperative dialoguing, with external support provided in the dynamic mediator-learner interaction, which features high sensitiveness to learners' ZPD: in other words, interactionist DA takes accounts of individual learners' development; Interventionist DA, on the other hand, provides a quantified number of standardized-formed assistances to prompt learners to reach a pre-specified outcome in an efficient manner.

It can be seen that the main difference between the two DA models lies in the way that mediation is provided: In Interactionist DA, mediation is dynamically provided through the mediator-learner interaction; In interventionist DA, mediation is sequentially provided with the pre-scripted prompts. However, for interactionist DA, its high sensitiveness to individual learners' development requires intensive work, which limits the contexts of its use; on the other hand, despite the limited flexibility of the mediations that interventionist DA provides, the standardization of mediation enables the DA's implementation with multiple learners (Poehner & Lantolf, 2013).

2.3 Computerized Dynamic Assessment (C-DA)

Computerized dynamic assessment (C-DA) is designed to assess test takers' various abilities in a computerized test, and when test takers give an incorrect answer to a test item, C-DA offers a tutorial program that re-examines the same concepts involved in the test item (Ghahderijani, Namaziandost, Tavakoli, Kumar, & Magizov, 2021). Ghahderijani et al. (2021) also believes that test takers' learning of the assessment items in the tutorial program can help assess their ZPDs. Poehner (2008) argues that C-DA can provide pre-constructed mediations to test takers in the process of an assessment, and it can serve multiple learners efficiently and ensure frequent re-assessment and automatic generation of learners' reports. Despite its recognized use (in the light of Vygotsky's SCT theory) in the assessment context, C-DA is also proposed as one component in the instructional context. Poehner and Lantolf (2013) propose the implementation of C-DA together with classroom-based DA in the classroom instruction, in order for teachers to better attune teaching to learners' ZPDs. However, the questions of

how C-DA mediates language learning and how effective are C-DA mediations have not been clarified in the literature.

3. C-DA studies in Second and Foreign Language Teaching

In order to select the appropriate empirical studies for literature review, the key words Computerized Dynamic Assessment and L2 are searched, and only peer-reviewed articles are selected. Furthermore, the abstracts of C-DA studies (from the searching results) have been examined to further refine the searching results and keep the ones that focus on the mediation of learners' language development. Based on the searching results, the main language skills that C-DA mediates mainly are reading, vocabulary and grammar.

The discussion of the selected studies focuses on the mediation provided and the effectiveness of the mediations. The discussion is first segmented into subsections based on the specific language skills that C-DA mediates, and then synthesized to answer the two research questions.

3.1 C-DA's Mediation of Learners' Reading Development

Teo (2012) studies the mediation of Taiwan EFL students inferential reading skills through C-DA. C-DA is delivered on a user-friendly software, and it is situated in an English language course at a Taiwan university. In other words, C-DA goes along with the daily instruction. The mediations that C-DA provides are pre-constructed based on the students' abilities presented in their pre-test. C-DA in this study provides four-level mediations progressing from the implicit to explicit. In other words, when students answer the questions incorrectly, the C-DA mediations will be shown in the order from implicitness to explicitness: from the most implicit mediation advising students to focus on the general idea of reading, to the less implicit mediation focusing on specific paragraphs, to the second most explicit one focusing on specific sentences and finally to the most explicit one providing and explaining the correct answers. It is noteworthy that the researcher refers to students' scores of C-DA to understand which mediation levels that individual learners repeatedly reach, and then uses that information for reference and performs one-on-one interactionist DA with learners. The study shows the improvement of students' inferencing skills as well as their meta-cognition on the inferencing skills, which demonstrates the effectiveness of the mediations that students have received. The C-DA mediations together with the mediations that the interactionist DA provides have shown their effectiveness in promoting inferencing reading skills; The C-DA mediations also inform the mediations of the interactionist DA.

Yang and Qian (2019) adopt C-DA to promote Chinese EFL learners' development of reading comprehension. The study features the quasi-experimental design with pre-/post-test for the control and experimental group. C-DA is solely used in the experimental group, both on the assessment and instruction. In the pretest, the experimental group incorporates the C-DA pre-scripted mediations into the multiple choice questions; In the treatment, the experimental group perform C-DA exercises with the pre-scripted mediations provided, and if students fail to answer correctly and remain on one C-DA

mediation, the teacher will further explain the C-DA mediation to the whole class. The post-test also adopts the same C-DA design as the pre-test. On the other hand, the control group features the same pre-/post-test without mediation provided, and their treatment does not involve C-DA. The study finds that the experimental group involving the use of C-DA outperforms the control group, which indicates the effectiveness of C-DA on promoting reading comprehension. For the C-DA mediations, they are pre-scripted and presented in the order from the implicit to explicit. Teacher helps explain the C-DA mediations if students have difficulty of understanding them, but such teacher's explanation is not made in a DA way that attunes to learners' ZPDs.

Bakhoda and Shabani (2019) investigate the use of computerized group dynamic assessment (C-GDA) for learners to promote reading comprehension in a classroom setting. Like other C-DA practices, the mediations are prefabricated and presented in the order from the implicit to explicit. However, the C-DA mediations involve the use of textual and picture information. The five-level C-DA mediations from implicit to explicit are: 1) reading the whole text again; 2) reading the beginning of each paragraph; 3) reading the highlighted vocabulary; 4) looking at the first picture while reading the highlighted vocabulary; 5) looking at the second picture while reading the beginning of each paragraph. It can be seen that Mediations 1 to 3 follow the usual mediation patterns for reading comprehension---from general to specific; However, Mediations 4 and 5 provide more explicit information by complimenting the textual information with picture information, to help further explain the accompanying texts for learners. Besides C-DA, this study also integrates the use of concurrent group dynamic assessment (GDA) which provides mediations to different learners in a classroom. C-DA and G-DA are integrated as C-GDA to involve both computer and human mediator. If a student provides an incorrect answer, the most implicit C-DA mediation will be provided by the human mediator to the student; if the student still provides an incorrect answer, the second most implicit C-DA mediation will be provided by the human mediator, but to a second student...and so on. The integration of C-DA and G-DA has demonstrated effectiveness in promoting the learners' reading comprehension, and it provides the chance of mediating a group of learners in a classroom by using both computer and human mediators.

Unlike their C-GDA study, Bakhoda and Shabani (2019) try to incorporate language learners' preferences of mediations into the design of C-DA for the facilitation of learners' reading comprehension. They provide three modes of mediation for learners' free selection: visual, audio and textual. C-DA has pre-scripted mediations proceeding from the implicitness to explicitness, in the three modes of mediations respectively. In the C-DA procedure, when learners provide incorrect answers, C-DA program will ask learners to select the preferred modes of mediation (among visual, audio and textual) and then to proceed with the mediations provided in the preferred modes. Overall, the study finds the learners' preferences are different in the modes of C-DA mediations, and also the effectiveness of the C-DA's mediations provided in the learners' preferred modes are confirmed on the promotion of learners' reading comprehension. This study contributes to C-DA studies by attempting to

address the issue of lacking human mediators. It takes account of learners' preferences on mediation modes and presents a variety of mediation modes, in order to appropriately respond to learners' needs and attune to their ZPDs. This study provides implications for the C-DA to present various modes of mediations for learners' reading comprehension.

Unlike the previous four studies, Estaji and Saeedian (2020) focus on the effectiveness of the DA mediations provided in different manners. They compare human-computer mediation, computer-only mediation and human-only mediation to investigate which manner of mediation better facilitates learners' reading comprehension. Computer-only mediations are prefabricated; human-only mediations are conducted by a mediator in a dialogic interaction; human-computer mediations are initially provided with the prefabricated prompts, and if the prompts cannot be understood, dialogic interaction with a mediator will be conducted. The study finds that all DA practices have shown effectiveness in promoting learners' reading comprehension, with human-computer mediations outperforming the human-only mediations and computer-only mediations.

3.2 C-DA's Mediation of Learners' Vocabulary and Grammar Development

When it comes to vocabulary development, C-DA is coupled with the use of noticing. Ebadi et al. (2018) studies the effectiveness of C-DA mediations and noticing on the learners' development of lexical referencing skills. In the quasi-experimental design, the experimental group of C-DA provides four-level pre-constructed mediations from implicit to explicit: 1). suggesting the answer is wrong and asking to think again; 2). highlighting the target word and the relevant parts of texts that can help understand the word; 3). specifying the relationship between the target word and the relevant parts of texts; 4). giving the correct answer and providing explanations. The study finds that C-DA facilitates vocabulary acquisition and retention. The study implies the combination of noticing and C-DA can enhance vocabulary learning from lexical inferencing. The graduated prompts of C-DA can increase the learners' noticing of the unfamiliar words. Similar to Ebadi et al. (2018), Ebadi, Vakilifard and Bahramlou (2018) develop a similar study and confirm the effectiveness of C-DA mediation and noticing on the learners' Persian vocabulary development.

Ai (2017) studies the graduated computer-mediated corrective feedback, in terms of its effectiveness in assisting learners to identify and correct potential grammatical issues. The mediations are provided mainly by an intelligent computer-assisted language learning system (proceeding from the implicit to explicit), and an online human mediator will provide remedies when the system fails to do its part. Unlike other C-DA software that has a fixed number of pre-scripted mediations, this system provides responsive mediations based on the types of syntactical errors that students make. The study finds that this intelligent system is effective in mediating students to self-identify and self-correct grammatical issues, and also implies the possibility of more graduated and interactive mediations provided by C-DA.

4. Discussion

Based on the C-DA studies above, it can be seen that most C-DA practices provide a fixed number of pre-constructed mediations—in other words, C-DA mainly adopts the interventionist DA model. Before being introduced to C-DA, all the pre-scripted mediations of C-DA were generated from mediator-learner dialogic interactions (interactionist DA) and were piloted with learners at the same proficiency levels, to make sure the pre-scripted mediations can maximally attune to learners' ZPDs. Also, the mediations are always provided in the order from the implicit to explicit. For the two studies of Bakhoda and Shabani (2019a, 2019b), the modes of C-DA mediations are not only limited to textual information.

However, the limited flexibility of pre-constructed mediations is one major drawback of C-DA. Some studies try to address this issue by incorporating additional human mediators. For example, In Teo's (2012) study, the researcher (also the human mediator) refers to the learners' performance in C-DA to see which mediation level learners are stuck at, and then uses the information for the subsequent one-on-one mediator-learner dialogic interaction (interactionist DA). In this case, C-DA not only mediates learners but also provides information to guide the subsequent DA practice. Ai (2017) and Andujar (2020) also involve the use of human DA mediations to remedy the failure of C-DA mediations. Alternatively, one study tries to address the issue by incorporating the learners' preferences on mediations into C-DA (Bakhoda & Shabani, 2019a).

For the effectiveness of mediations, all the studies have demonstrated the positive impact of DA mediations on the promotion of learners' language abilities in reading, vocabulary and grammar. However, the effectiveness is not all attributed to C-DA mediations. Teo (2012), Yang and Qian (2019), Ai (2017) and Andujar (2020) have demonstrated that the effectiveness comes from both C-DA and human mediation. Ebadi, Vakilifard and Bahramlou (2018) and Ebadi et al. (2018) also mention that the integration of both C-DA mediations and noticing effect contributes to the development of lexical referencing skills.

5. Limitation and Conclusion

To sum up, the literature review seems to suggest that C-DA mostly adopts a fixed number of pre-constructed mediations to facilitate learners' language development. Given the limited flexibility of C-DA mediations, human mediation can be introduced to compliment C-DA in order to better attune to learners' ZPDs. The effectiveness of mediations can be largely ascertained, however, such effectiveness needs to be interpreted by taking account of additional factors other than C-DA mediations (e.g. human mediation).

The main limitation lies in the limited C-DA studies that are reviewed. Based on the searching results of C-DA relevant studies (only 10 studies), it can be seen that C-DA mediations and their effectiveness are largely under-researched. Therefore, the findings of this literature review cannot be generalized. More studies need to be conducted in C-DA to further test the conclusions above. However, important

implications can still be made from this review. For example, the review indicates that researchers have realized the limitation of using C-DA alone, and some of them have included human mediations to help better attune to learners' ZPDs. Andujar (2020) addresses the C-DA's limitation by introducing the mode of mobile-mediated DA—which adopts DA in the Whatsapp application. Mediations are provided in a group chat of Whatsapp in the form of a mediator-learner interaction. The mediator (also the teacher) provides mediations from an inventory of prompts proceeding from implicit to explicit. Unlike other C-DA studies with pre-scripted prompts, the mediator in the study provides more levels of mediation, including repetitive question-asking to elicit students' attentions to the erroneous parts (before pointing out the erroneous parts). However, how human-and-computer DA should be delivered is still largely under researched, and it is worth more attention for future C-DA studies.

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