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Learners' use of audio/video playback controls in technology-enhanced listening: a systematic review

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This systematic review investigates learner use of audio/video playback (AVP) controls in technology-enhanced listening environments. To this aim, 61 academic works produced from 2000–2021 underwent inclusion/exclusion criteria and were analyzed. The resulting corpus was made up of 16 peer-reviewed articles. We first situate the studies examined with regards to contextual, educational, and methodological characteristics of AVP controls research. Then, we conducted thematic analysis to identify, analyze and report affordances and limitations of AVP controls. Four affordances and two limitations were identified. The affordances describe how AVP controls enable students to resort to different strategies, change their interaction patterns with learning materials, address comprehension problems and enhance listening comprehension performance. Similarly, limitations describe how proficiency level restricts interaction with AVP controls and the need for learner training on AVP controls. Results are discussed along with integrated data. Pedagogical implications and avenues for further research are also discussed.

Keywords: audio/video playback controls, listening comprehension, learner control, systematic reviews

As the provision of audio/video playback (AVP) controls is a staple of second language (L2) listening materials, levels of control provided to L2 listeners is a key feature of technology-enhanced listening materials. AVP controls or features found in computer media players enable listeners/viewers to skip text segments, replay partial or full texts, rewind and forward texts and pause or stop

incoming flow of information at their will (Cárdenas-Claros, 2011; Hegelheimer & Tower, 2004). All these actions are performed by language instructors in teacher-centered classrooms. In technology-enhanced listening environments, these decisions are left to L2 learners to make.

Researchers agree that interaction with AVP controls results in multiple gains for L2 learners. Cross (2017) notes that interaction with AVP controls not only stimulates language learning, but also promotes learner autonomy as learners benefit from computer assistance according to their own learning needs and preferences. Jensen and Vinther (2003) stress the positive impact AVP controls exert over text comprehension as input repetition provides feedback to their hypotheses about language form and meaning. Similarly, Cárdenas-Claros et al. (2021) and Tower and Hegelheimer (2014) note that AVP controls allow listeners to compensate for comprehension problems as they are able to stop and digest information which facilitates text comprehension and task completion. Additionally, Jensen and Vinther (2003) highlight how effective interaction with AVP controls enables learners to develop strategies for phonological decoding.

Despite the above gains, learner autonomy afforded through AVP controls is often overlooked and taken for granted. Moreover, studies with a focal interest on AVP controls are limited. Most existing technology-enhanced listening research has directed its attention towards various ancillary elements such as: captions (Gass et al., 2019; Hosogoshi, 2016; Mohsen, 2016; Montero Perez et al., 2014; Pattenmore & Muñoz, 2022; Sydorenko, 2010), transcripts (Cárdenas-Claros & Campos-Ibaceta, 2018; Danan, 2016; Grgurović & Hegelheimer, 2007), glossary and/or dictionaries (Grgurović & Hegelheimer, 2007; Rivens-Mompean, 2009) and, more recently, feedback (Cárdenas-Claros, 2022). Remarkably, research focusing on AVP controls remains scarce. This is precisely the gap this study intends to address.

This systematic review sought to analyze the results of empirical studies examining the use of AVP controls to identify research trends and highlight pedagogical implications. Accordingly, we examined 61 academic works published between 2000–2021 that included empirical and theoretical articles published in computer-assisted language learning (CALL), applied linguistics, and language education journals. Following Page et al. (2021)'s work on systematic reviews and Leary and Walker (2018), we identified, screened, established inclusion/exclusion criteria, and set up a corpus of 16 studies to identify affordances and limitations.

We open this paper by discussing AVP controls from a second language acquisition (SLA) and a technology-enhanced listening standpoint. Then, we describe the procedures for the systematic review construction and provide a sound account of contextual, educational, and methodological characteristics of AVP controls research. Additionally, we identify affordances and limitations. At the conclusion, we identify gaps and avenues for further research and introduce a series of pedagogical implications.

Theoretical framework

This work views listening as an active, complex, meaning-construction process at the intersection of hearing, cognition, attention, and nearly automatic and simultaneous linguistic, psycho-linguistic, and pragmatic processing (Field, 2013). Field (2013) delineates two distinct tiers of L2 processing: lower-level processes (comprising input decoding, lexical search, and parsing) and higher-order processing (encompassing meaning representation and discourse representation).

In the lower-level processes, or perceptual processes, aural input undergoes a transformation from a sequence of sounds to word strings and, subsequently, to propositional representations that denote the listener's literal interpretation of the text. Field (2013) identifies three lower-level processes: input decoding, lexical search, and parsing. Input decoding relies on phonological knowledge and describes the process by which the auditory signal is comprehended and decoded into phonemes. Lexical search centers on the matching of words from the incoming input with the listener's existing lexicon and draws support from lexical knowledge. Finally, parsing relies on syntactical knowledge. The exposure to diverse speakers and text types facilitates the automatization of lower-level processes, ultimately freeing up cognitive resources for subsequent engagement in higher-level processes.

Higher-level processes in Field's (2013) framing are predominantly associated with comprehension and are composed of two-level processes: meaning representation and discourse representation. Meaning representation initiates the conscious or unconscious activation of schemata, which are characterized as "a knowledge structure containing all that an individual knows about and associates with a particular concept" (p. 101). This representation amalgamates contextual information, schematic knowledge, and the inferences drawn by the listener from the text. Discourse representation addresses the micro and macro structures inherent in discourse allowing listeners to recognize them.

This model, initially designed within the context of language testing, offers a robust framework for crafting input-based tasks while allowing designers to pinpoint specific targeted proficiency levels.

Computer-based L2 listening

Situated in the field of CALL, computer-based listening, also known as technology-enhanced listening, refers to the use of digital devices, streaming media, and interaction with enhanced input (Cárdenas-Claros et al., 2021; Hubbard, 2017; Montero-Perez, 2019).

Computer-based L2 listening promotes student-centered learning. Routinely in teacher-centered classrooms, language teachers make most of the decisions with regards to students' listening goals and problems. Therefore, they decide what texts students need to listen to, how many times texts need to be played and what text segments they need to replay as teachers foresee what lexical items and parts of the texts L2 listeners may find difficult to understand.

In computer-based L2 listening, all these decisions are made by the learner (Cárdenas-Claros et al., 2021).

Learner-computer interaction and learner control are the epitomes of computer-based listening (Cárdenas-Claros et al., 2021). Similar to two-way listening where L2 learners modify input through interaction and use different strategies to compensate for and repair from breakdowns in comprehension (i.e., ask for clarification, use comprehension checks or ask their interlocutors to repeat input), in computer-based L2 listening, opportunities for computer-learner interaction are promoted through exposure to enhanced input. Enhanced input takes the form of textual support through transcripts, subtitles and/or captions for L2 learners to check and confirm understanding; AVP controls to replay, pause, and stop the stream of aural/visual input to comprehend spoken texts; access hyperlinks and glossaries to check word meanings; consult culture notes to understand where texts originate from and access feedback to assess their performance (Cárdenas-Claros & Gruba, 2009; Hubbard, 2017).

Audio/video playback controls

AVP controls, also known as audio/video control buttons, allow L2 listeners or viewers to reproduce audio or video files on the computer. Tablets, mobile phones, desktop computers and/or laptops all are computers (Cárdenas-Claros, 2021; Hubbard, 2017). The symbols for playing, pausing, and stopping the flow of aural/visual information are well-known by language learners as these are universal, intuitive, and user-friendly. Potentially, through the provision of AVP controls, learners are invited to interact with a click-a-way enhanced input, to notice relevant language features (Chapelle, 2003), immediately repair from breakdowns in understanding (Cárdenas-Claros & Gruba, 2014) and facilitate L2 processing (Cárdenas-Claros & Gruba, 2009; Hubbard, 2017; Schmidt & Hegelheimer, 2004).

The use of AVC buttons allows L2 listeners to manipulate texts, thereby influencing various aspects of, primarily lower-level processes, in Field's (2013) framing. For instance, the ability to pause, rewind, and replay audio/video segments leads learners to revisit challenging sections, seek clarification for misunderstandings, or engage in content review. These actions may strengthen the listeners' ability to decode and comprehend spoken language. Additionally, AVP controls allow listeners to navigate through different accents, pitch ranges, and speech rates. This exposure may aid in input decoding and lexical search and, if used together with transcripts, in word segmentation skills. Finally, as listeners can adjust the playback speed, it may facilitate the parsing of spoken language.

AVP controls have been explored both from a SLA standpoint and from CALL theorizing and research. From a SLA perspective, interaction with AVP controls have been explained through an interactionist approach to language learning. In this context, not only manipulation of input through interaction is paramount for comprehension but also learners' attention needs to be directed to salient linguistic features of the input (Gass & Mackey, 2006; Loewen & Sato,

2018). Salient input makes marked characteristics in a language easier to be noticed (Gass et al., 2018) and therefore “more likely to be perceived, to be attended to, and are more likely to enter into subsequent cognitive processing and learning” (Ellis, 2016, p. 342). Repetition is a form of salient input identified as a fundamental factor in the development of listening comprehension (Chang & Read, 2006; Holzknicht & Harding, 2023; Mohsen, 2016).

From a computer-based listening standpoint, Chapelle (2003) outlined three ways in which researchers and material designers can enhance input. This includes (a) incorporating multiple instances of the target form, (b) providing learner control over program features for varied interactions with the input, and (c) ensuring the use of the same linguistic input in different situations and modes. Playback controls notably address the second aspect by allowing listeners to interact with input repeatedly through features like replay, forward, and rewind. Based on Chapelle (2003), Cárdenas-Claros and Gruba (2014) put forward the CoDe framework; an empirically-based initiative to ground the Conceptualization and Design (CoDe) of help options. Compensatory options encompass aural-to-visual, visual-to-visual, and aural-to-aural modifications. AVC buttons, as a type of aural-to-aural modification, enable listeners to manage breakdowns in understanding during listening by repeating, slowing down, or skipping through text segments (Cárdenas-Claros & Gruba, 2014).

Given the importance of AVP controls for supporting listening comprehension and task completion (Goss, 1982; Rost, 2005; Vandergrift, 1999; Vogely, 1995), effective use of AVP controls may be taken for granted, particularly by low proficiency learners (Çakmak & Erçetin, 2017; Hegelheimer & Tower, 2004; Pujolà, 2002). Although AVP controls research has mostly been done in tandem with other ancillary elements, very few have provided clear guidelines to inform L2 listening instruction. Therefore, in this systematic review we first examine available empirical studies to identify trends on AVP controls research, and then identify reported affordances and limitations. Set out as research questions, this systematic review investigates:

1. What are the contextual, educational, and methodological characteristics of AVP controls research?
2. What are the perceived affordances of interacting with AVP controls?
3. What are the perceived limitations of interacting with AVP controls?

Method

Given the limited number of studies with a focal interest on the use of AVP controls in technology-enhanced listening and to spur research on the area, we selected a systematic review as a methodology for this investigation as it fosters interpretation of findings from primary studies (Jaramillo-Yanquepe, 2022), leads to identification of gaps in the literature, brings research results together, updates knowledge on the topic and allows scholars to establish clear lines for further research (Cooper, 2016; Ludvigsen, et al., 2016). In particular, we seek to translate isolated findings meaningfully to inform research and pedagogical practice on AVP controls usage in technology-enhanced listening.

Data collection stages

To collect data for this systematic review, we followed the PRISMA 2020 model (Page et al., 2021) that identifies four main stages: identification, screening, eligibility, and inclusion. For the identification stage, we conducted a purposive search to retrieve relevant works addressing the topic of the systematic review. Thus, Google Scholar and the five databases (EBSCO, Taylor & Francis, E-journals, Scopus, and Web of Science), accessed through the Sistema Bibliotecas from a research-leading university in central Chile, served as primary databases. The data collection stage was initially shaped by seven search terms that emerged from the research questions (Leary & Walker, 2018) of this study: “listening comprehension”, “computer-assisted language learning”, “technology-enhanced listening”, “help options”, “learner control”, “audio/video control buttons”, and “repetition”. Later on, we used synonyms to expand our search. Thus, “self-access”, “self-regulation” and “learners’ moves” were used as synonyms for learner control. Additionally, “listen again”, “stop”, “rewind”, and “fast forward”, “playback controls”, “ABC buttons”, “repeat button”, “replay buttons” and “control buttons/bars” were used as alternative terms for audio/video playback controls and “mobile-assisted language learning” and “hand-held devices’ derived from literature related to the use of technology in language learning and served as synonyms for computer-assisted language learning. Consequently, this search resulted in 973 works.

In the screening stage, duplicates were removed, and 71 works were screened. Ten additional works were removed as they were not academic works. The screening phase resulted in a final fully scrutinized corpus of 61 studies (Figure 1) which included all kinds of academic publications (journal articles, book chapters, conference proceedings, editorials, etc.) related to the search terms.

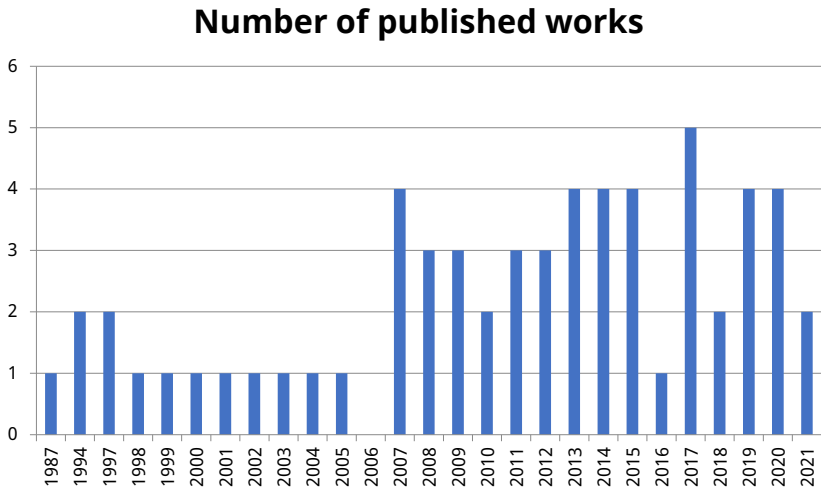


Figure 1. Number of academic works on use of AVP controls for language learning (n=61)

Figure 1 shows the spread of publications on AVP controls research in the 1987–2021 period. The numbers in the bars represent the number of related publications. The findings show that work addressing AVP controls in computer-based L2 listening was first published in 1987 with five works published in the 2017 year, followed by four works published in the 2007, 2013, 2014, 2015, 2019 and 2020 years. In 2006 no works were published.

For the eligibility stage, we refined our criteria for inclusion and only included articles reporting empirical studies that came from an indexed peer-reviewed journal. In fact, out of the 61 works, 12 were theoretical papers and 49 were empirical works. We also discarded works that did not thoroughly describe data collection and data analysis procedures. Interestingly, works before the year 2000 did not comply with any criteria, therefore, we narrowed down our inclusion criteria.

In the inclusion stage, we only scrutinized works that fully met the following criteria:

1. Works published from 2000–2021.
2. Academic works that demonstrated a peer-review process.
3. Works that provided empirical results.
4. Works that provided a sound methods section. That is, works that allow researchers to evaluate the validity and reliability of the findings.
5. Studies also met the following thematic criteria:
 - a. Studies addressing learner control on listening.
 - b. Studies conducted on a CALL or technology-enhanced environment.
 - c. Studies focusing on any type of audio/video playback controls (e.g. stop/pause, rewind, forward and repeat buttons).

Out of the 61 works, we discarded 45 works for the following reasons: 31 addressed other help options; three were teacher-centered; three addressed other skills; and four were not developed in technology-enhanced listening environments. Moreover, two were PhD theses, two were conference proceedings, and seven did not fit the time frame. Figure 2 summarizes the article selection process. The total number of records included in the review are 16 research articles.

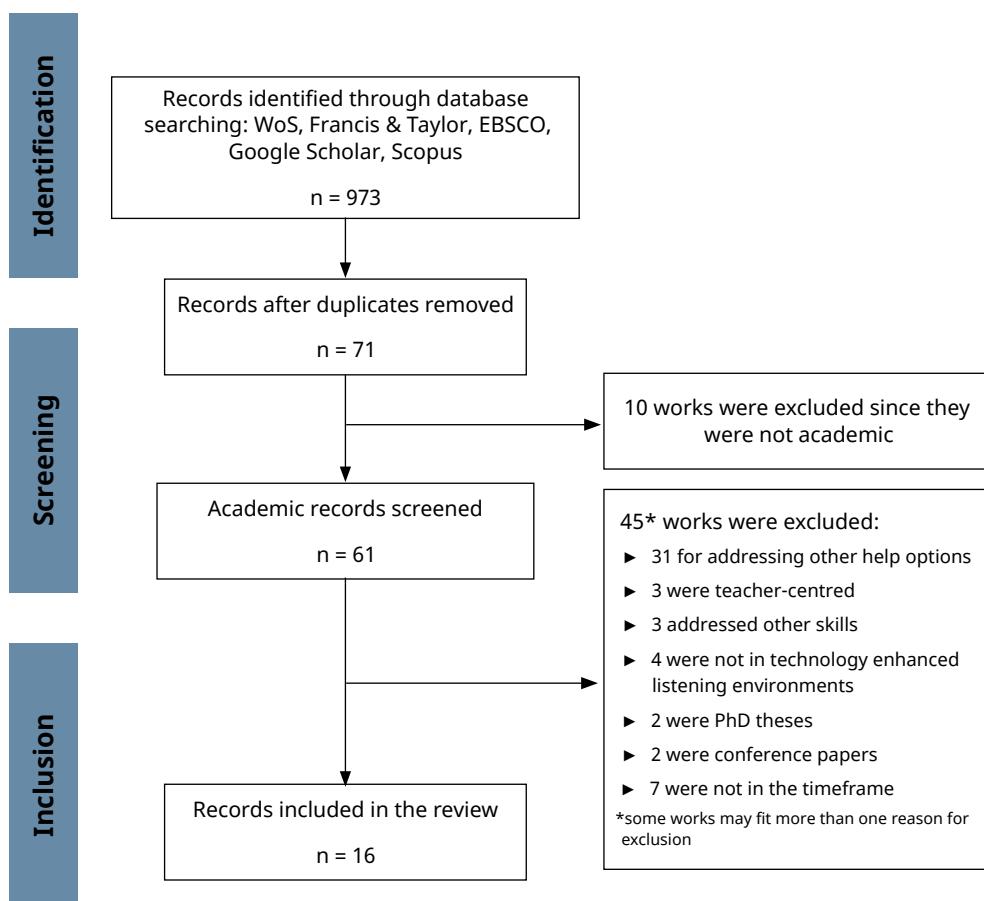


Figure 2. Article selection processes

Data analysis

To answer RQ1, the following information from the 16 research articles that complied with the inclusion criteria was extracted: research question(s), number of participants, L1, target language, academic background, proficiency, educational context, types of texts, tasks length, data collection time, materials, and research design.

To answer RQ2 and RQ3, thematic analysis was used to identify affordances and limitations of AVP controls used by L2 learners. We followed Miles et al. (2014) and Braun and Clarke (2021) for qualitative data analysis. Accordingly, we did not start with a pre-established coding protocol, but we used a bottom-up approach to analysis. The main author read the complete 16 articles and jotted down affordances and limitations found in each article and followed procedures for open coding. Then, she identified common findings and grouped them accordingly. An initial coding protocol that included “learner’s use and gains of interaction with AVP controls” and “challenges of using AVP controls” was established. Then, she changed the wording from “gains” to “affordances” and “challenges” to “limitations”. Lastly, she performed selective coding (Table 1). The resulting analysis was discussed with the second researcher who fully agreed with the emerging affordances and limitations.

Table 1. Affordances and limitations of AVP controls research

Findings	Definition	Number of articles
Affordance 1: Listeners can resort to different strategies when using AVP controls.	The strategies learners resort to which may vary according to the time the input is presented, the purposes behind strategy use, and familiarity with AVP controls.	9 articles: Cárdenas-Claros et al. (2021); Çakmak and Erçetin (2017); Grgurović and Hegelheimer (2007); Hegelheimer and Tower (2004); Liou (2000); Pujolá (2002); Rivens-Mompean (2009); Roussel (2011); Tan et al. (2021)
Affordance 2: Listeners can change strategies and interaction patterns with AVP controls as they familiarize with learning environments.	Learners adapt their strategies and interaction patterns as they become more acquainted with the learning environment.	5 articles: Cárdenas-Claros et al. (2021); Grgurović and Hegelheimer (2007); Hegelheimer, and Tower (2004); O'Bryan and Hegelheimer (2009); Tan et al. (2021)
Affordance 3: Listeners can address comprehension problems when interacting with AVP controls.	AVP controls are used to address comprehension problems.	9 articles: Cárdenas-Claros (2020); Liou (2000); McBride (2011); O'Bryan and Hegelheimer (2009); Ozcelik et al. (2019); Ozcelik et al. (2020); Rodrigo (2017); Shalmani (2008); Tan et al. (2021)
Affordance 4: Listeners can enhance their listening comprehension performance.	Use of AVP controls help learners to aid listening comprehension.	6 articles: McBride (2011); O'Bryan and Hegelheimer (2009); Ozcelik et al., (2020); Rodrigo (2017); Shalmani (2008); Tan et al. (2021)
Limitation 1: Proficiency level limits learners' use of AVP controls.	Constraints associated with proficiency level and AVP controls.	4 articles: Grgurović and Hegelheimer (2007); Hegelheimer and Tower (2004); Ozcelik et al. (2020); Roussel (2011).
Limitation 2: Learners need training on AVP controls usage.	Learners' lack of training on the use of AVP controls.	3 articles: Cárdenas-Claros et al. (2021); Grgurović and Hegelheimer (2007); Roussel (2011).

Results

Contextual and educational characteristics of AVP controls research

The systematic review was conducted on 16 research articles, all of them written in English and that were published in any of nine different peer-reviewed journals from which five specialize in technology and language teaching (*Computer Assisted Language Learning Journal*, *Language Learning & Technology*, *System*, *ReCALL*, and *The JALT CALL Journal*), two in applied linguistics (*The Canadian Journal of Applied Linguistics*, and *International Journal of Listening*), and two in language education (*Journal of Teaching English Language* and *Journal of Spanish Language Teaching*). The journals cover a narrow range of geographical locations. Thus, most articles were published in journals based in Europe (5), North America (2), and Asia (2). Contextual and educational characteristics are presented in Table 2.

Table 2. Articles included in the systematic review

Author(s)	Year	Title of publication	Approach	Journal name & language
Liou, H.	2000	Assessing learner strategies using computers - New insights and limitations	Quant.	Computer Assisted Language Learning. (English)
Pujolà, J.	2002	CALLing for help: researching language learning strategies using help facilities in a web-based multimedia program	Qual.	ReCALL. (English)
Hegelheimer, V., & Tower, E.	2004	Using CALL in the classroom: Analyzing student interactions in an authentic classroom	Quant.	System (English)
Grgurović, M., & Hegelheimer, V.	2007	Help options and multimedia listening: Students' use of subtitles and the transcript	Mixed	Language Learning & Technology (English)
Shalmani, H.	2008	On the effects of help options in MCALL programs on the listening comprehension of EFL learners	Quant.	Journal of Teaching English Language (English)
O'Bryan, A & Hegelheimer, V.	2009	Using a mixed methods approach to explore strategies, metacognitive awareness, and the effects of task design on listening development	Mixed	The Canadian Journal of Applied Linguistics (English)
Rivens-Mompean, A & Guichon, N.	2009	Assessing the use of aids for a computer- mediated task: taking notes while listening	Quant.	The JALTCALL Journal (English)
McBride, K.	2011	The effect of rate of speech and distributed practice on the development of listening comprehension.	Quant.	Computer Assisted Language Learning Journal (English)
Roussel, S.	2011	A computer assisted method to track listening strategies in second language learning	Quant.	ReCALL (English)
Cárdenas-Claros, M. & Gruba P.	2014	Listeners' interactions with help options in CALL	Qual.	Computer Assisted Language Learning Journal (English)
Rodrigo, V.	2017	Quantifying comprehension gains after repeated listening by students of Spanish with different listening ability: an exploratory study	Quant.	Journal of Spanish Language Teaching (English)
Ozcelik, H., Van den Branden, K. & Van Steendam, E	2019	Listening comprehension problems of FL learners in a peer interactive, self-regulated listening task	Quant.	International Journal of Listening (English)
Ozcelik, H., Van den Branden, K. & Van	2020	Alleviating effects of self-regulating the audio on listening comprehension problems	Qual.	International Journal of Listening (English)
Ozcelik, H., Van den Branden, K. & Van	2020	Alleviating effects of self-regulating the audio on listening comprehension problems	Qual.	International Journal of Listening (English)

Author(s)	Year	Title of publication	Approach	Journal name & language
Cárdenas-Claros M.	2020	Spontaneous links between help option use and input features that hinder second language listening comprehension	Qual.	System (English)
Tan, C., Chen, C. & Lee, H.	2021	Effectiveness of a digital pen-based learning system with a reward mechanism to improve learners' metacognitive strategies in listening	Quant.	Computer Assisted Language Learning Journal (English)
Cárdenas-Claros, M., Campos-Ibaceta, A. & Vera-Saavedra, J.	2021	Listeners' patterns of interaction with help options: Towards empirically-based pedagogy.	Qual.	Language Learning & Technology (English)

Regarding target language, 13 studies focused on English as a foreign language (Cárdenas-Claros & Gruba, 2014; Cárdenas-Claros, 2020; Cárdenas-Claros et al., 2021; Hegelheimer & Tower, 2004; Liou, 2000; McBride, 2011; Ozcelik et al., 2019, 2020; Pujolà, 2002; Rovens-Mompean & Guichon, 2009; Roussel, 2011; Shalmani, 2008; Tan et al., 2021), two investigations considered ESL (Grgurović & Hegelheimer, 2007; O'Bryan & Hegelheimer, 2009), and one study focused on the teaching of Spanish (Rodrigo, 2017). Therefore, more research on the use of AVP controls should be done with a broader range of target languages.

An analysis of educational settings showed that 12 studies were conducted with students from higher education (Cárdenas-Claros & Gruba, 2014; 2020 & 2021; Grgurović & Hegelheimer, 2007; Hegelheimer & Tower, 2004; Liou, 2000; McBride, 2011; Pujolà, 2002; O'Bryan & Hegelheimer, 2009; Rovens-Mompean & Guichon, 2009; Rodrigo, 2017; Shalmani, 2008), three investigations were conducted with high-schoolers (Ozcelik et al., 2019; Ozcelik, et al., 2020; Tan et al., 2019) with six graders as the youngest participants, and one study did not provide clear information about its context (Roussel, 2011). Consequently, there is a need to conduct studies with middle school and primary school students as well as adult learners and those who are outside of mainstream education settings such as language schools or people who learn on their own.

Methodological characteristics of AVP controls research

We present results regarding the research designs, participants characteristics, input text characteristics, and data collection instruments and procedures.

Research designs. Analysis of the research designs employed in the 16 studies shows that 10 studies used a quantitative methodology (Hegelheimer & Tower, 2004; Liou, 2000; Ozcelik et al., 2019, 2020; Rovens-Mompean & Guichon, 2009; Rodrigo, 2017; Roussel, 2011; Shalmani, 2008; Tan et al., 2021), four investigations were qualitative studies (Cárdenas-Claros & Gruba, 2014; 2020, and 2021; Pujolà, 2002), and two studies stated using mixed-methods (Grgurović &

Hegelheimer, 2007; O'Bryan & Hegelheimer, 2009). Then, we suggest that more research with a qualitative focus is needed.

Participants. The number of participants examined varied dramatically and was in the range of two to 200 participants. For instance, in O'Bryan and Hegelheimer (2009) there were less than five students. Additionally, the analysis showed that nine studies included between 13 to 30 participants as in the works by Cárdenas-Claros et al. (2021) and Roussel (2011). Three studies involved between 48 to 94 participants (Hegelheimer & Tower, 2004; Rodrigo, 2017; Tan et al., 2021;) and the studies by McBride (2011) and Shalmani (2008) relied on 141 and 200 participants respectively.

Regarding the characteristics of the participants, the data was examined with regards to proficiency level and language background of the participants. The proficiency level varied widely. That is, 10 studies examined intermediate learners (Cárdenas-Claros & Gruba, 2014; Cárdenas-Claros, 2020; Cárdenas-Claros et al., 2021; Grgurović & Hegelheimer, 2007; O'Bryan & Hegelheimer, 2009; Rodrigo, 2017; Rivens-Mompean & Guichon, 2009; Roussel, 2011; Shalmani, 2008; Tan et al., 2021), five included high (Ozcelik et al., 2019; 2020; Hegelheimer & Tower, 2004) or low beginners (Rivens-Mompean & Guichon, 2009), one study described participants proficiency as belonging to “the 4th and 5th level of e Escola Oficial d’Idiomes 2”(Pujolà, 2002, p. 243), one study looked at a range of proficiencies (beginner to advanced) as in McBride (2011) and one study (Liou, 2000) did not provide this information. Subsequently, more research targeting low-proficiency learners is needed. The language background of participants was also diverse. It was possible to identify American (Rodrigo, 2017), Chilean (Cárdenas-Claros, 2020, 2021; McBride, 2011), Colombian (Cárdenas-Claros & Gruba, 2014), Asian (Grgurović & Hegelheimer, 2007; Tan et al., 2021), Emirati nationals (Hegelheimer & Tower, 2004), Iranian (Shalmani, 2008), French (Rivens-Mompean & Guichon, 2009), and Flemish (Ozcelik et al., 2020) as the predominant nationalities. However, a small number of participants were Indian, Malaysian, Peruvian, and Vietnamese. Therefore, more research is needed with participants from the Global South.

Input text characteristics. Input text characteristics are described regarding authenticity (authentic vs. non-authentic materials), genre (podcasts, TV shows and talks) text types (narrative, argumentative) and/or software type (commercially available and fit-for-purpose). Regarding materials, analyses show that the types of texts used comprised authentic online materials such as podcasts (O'Bryan & Hegelheimer, 2009), radio programs from the BBC (Ozcelik et al., 2019 & 2020), TED talks (Cárdenas-Claros, 2020 & Cárdenas-Claros et al., 2021), film extracts (Liou, 2000), and an authentic audio library that complemented textbook materials (Rodrigo, 2017). Other studies relied on non-authentic materials such as pre-recorded academic lectures (Grgurović & Hegelheimer, 2007; Shalmani, 2008) and dialogues recorded at different speech rates (McBride, 2011). Additionally, three research works labeled their texts as speech (Roussel, 2011), two as informative (Cárdenas-Claros, 2020, Cárdenas-Claros et al., 2021),



one as a narrative monologue (Rodrigo, 2017), one as a dialogue (McBride, 2011) and one study did not clearly report this information as texts were presented as Radio or Video (Pujolà, 2002). Additionally, regarding type of software, Cárdenas-Claros and Gruba (2014) worked with commercially-available software such as the English Learning Online interactive. Hegelheimer and Tower (2004) worked with courseware, Rivens-Mompean and Guichon (2009), Tan et al. (2021) and Cárdenas-Claros et al. (2021) relied on fit-for-purpose software, such as the Improve your listening skills platform (Cárdenas-Claros et al., 2021) and ImpreSSions (Pujolà, 2002).

Data collection instruments and procedures. Researchers used a variety of data collection instruments. For instance, Cárdenas-Claros and Gruba (2014, 2021), Grgurović and Hegelheimer (2007), Roussel (2011) and Rivens-Mompean and Guichon (2009) tracked listeners' interactions with AVP controls with screen capturing software, and Liou (2000) with tracking systems. Tan et al. (2021) used questionnaires, Cárdenas-Claros and Gruba (2014), Cárdenas-Claros et al. (2021) and Grgurović and Hegelheimer (2007) complemented data with verbal reports elicited through semi-structured interviews. Shalmani (2008), McBride (2011) and Rodrigo (2017) included listening comprehension tests in their pre-test/post-test designs. Other data collections tools such as placement tests and recall tasks were used in three studies (O'Bryan & Hegelheimer, 2009; Hegelheimer & Tower, 2004; Rodrigo, 2017).

The procedures and time frame for data collection also varied considerably. While, one study was conducted in a 16-week semester (O'Bryan & Hegelheimer, 2009), six studies took between two to 10 weeks (Cárdenas-Claros, 2020; Grgurović & Hegelheimer, 2007; Hegelheimer & Tower, 2004; McBride, 2011; Pujolà, 2002; Tan et al., 2021). Notably, three studies did not describe their time frame for data collection (Liou, 2000; Rivens-Mompean & Guichon, 2009; Roussel, 2011) and three research works developed their experiments in a single session (Ozcelik et al., 2019; Rodrigo, 2017; Shalmani, 2008). Clearly, there is a need for more longitudinal not cross-sectional studies.

The reported time of learners interacting with tasks was in the range of three minutes to two hours. Three studies assigned individual tasks that lasted between three to 30 minutes (Hegelheimer & Tower, 2004; Liou, 2000; O'Bryan & Hegelheimer, 2009; Ozcelik et al., 2019, 2020; Rivens-Mompean & Guichon, 2009; Roussel, 2011; Tan et al., 2021) while five lasted between 47 minutes to two hours (Cárdenas-Claros & Gruba, 2014, 2020; Grgurović & Hegelheimer, 2007; Pujolà, 2002; and Shalmani, 2008). Considerably, six studies did not provide this information (Hegelheimer & Tower, 2004; Liou, 1995; McBride, 2011; Ozcelik et al., 2019; Rodrigo, 2017; Roussel, 2011). All things considered, we believe researchers need to provide thorough accounts of learner-computer interaction times to better assess the quality of the results.

As a result of systematic qualitative data interrogation, we identified six categories of AVP controls research, namely, (1) listeners can resort to different strategies when using AVP controls, (2) listeners can change strategies and interaction patterns with AVP controls as they familiarize with learning environments, (3) listeners can address comprehension problems when interacting with AVP controls, and (4) learners can improve performance. Also, we identified two limitations: (1) proficiency levels limit use of AVP controls and (2) learners need training on AVP controls usage.

Affordance 1: Listeners can resort to different strategies when using AVP controls.

Listeners make use of a number of strategies when interacting with AVP controls. Tan et al. (2021) examined the metacognitive strategies (planning, monitoring and evaluating) used by 52 learners of English, as they interacted with glossary and AVP controls in a Digital Pen-based Learning System Reward Mechanism (DPLS-RM). Tan et al. (2021) claimed that the design of the DPLS-RM system was grounded on a metacognitive model and enabled learners to perform different tasks. First, learners were able to choose their listening task according to proficiency and interest (planning). Then, students who did not overuse AVP controls and glossary options, were awarded more points as they left their appropriate use to other stages of the task (monitoring). Finally, learners received feedback upon task completion and were encouraged to go over the task to improve their performance (evaluating). After analyzing control and treatment groups, results suggested that those learners who received reward points, that is, who limited their use of AVP controls and the glossary, increased their metacognitive awareness since the DPLS-RM system guided them in their listening process. Similarly, Rivens-Mompean and Guichon (2009) identified the use of strategies such as “global viewing” and “split viewing” as they observed 16 higher education learners interacting with AVP controls. That is, students preferred listening without interruptions the first time and then pausing or rewinding the second one. Likewise, Roussel (2011) conducted four experiments with 30 low and high-intermediate participants. Roussel (2011) explained listeners’ use of strategies from a metacognitive perspective when observing interactions with AVP controls and textual elements. Results evidenced that there is a relationship between proficiency level and quantity of interaction with AVP controls. Thus, higher proficiency listeners exhibited the use of “more elaborate listening strategies and plan their listening task judiciously” (Roussel, 2011, p. 114). By the same token, Pujolà (2002) examined 22 Spanish adult learners who participated in four lessons in a CALL software called ImPRESSions. Pujolà (2002) identified a tendency for global understanding and reluctance to use AVP controls and other help options.

While some listeners use strategies purposefully, some others tend to be erratic and less effective. Hegelheimer and Tower (2004) conducted a study in the United Arab Emirates with 94 high and low proficiency participants from higher education. The authors reported a significant difference in the use of AVP controls and dictionaries among learners. While some interacted with

AVP controls when not necessary, others neglected dictionaries completely. Moreover, participants frequently used the repeat button over other types of input modification. This was explained by a lack of training on the use of help options since the repeat button was the only option that was deliberately introduced to learners (Hegelheimer & Tower, 2004).

Affordance 2: Listeners can change strategies and interaction patterns with AVP controls as they familiarize themselves with learning environments.

Cárdenas-Claros et al. (2021) analyzed listeners' patterns of interaction as 13 high-intermediate learners of English from Chile worked with different exercise types presented in pre-, while-, and post-listening exercises in six different sessions. The author reported that the AVP controls were sporadically used in the first encounters and these "were better regulated as listeners made use of input provided through the feedback" (Cárdenas-Claros et al., 2021, p.17). Likewise, learners progressively increased their interaction with AVP controls after being occasionally used at the beginning. Grgurović and Hegelheimer (2007) claimed that learners mostly used AVP controls and associated captions because they were acquainted with them. In their study, 18 intermediate ESL learners interacted with subtitles through AVP controls more frequently than with transcripts given their exposure to captioned materials viewing. Hegelheimer and Tower (2004) reported a tendency from learners to use those AVP controls which they were acquainted with post-training. However, after spending time on the program, there was evidence that learners also tried other AVP controls which also aided their listening comprehension successfully. Tan et al. (2021) reported that in the first few rounds of listening practice, the significant sequences of the learners included RSF (repeat sentence function) but toward the end students preferred the LF (listening function), suggesting a change in behavior as they familiarize with the pen-based mechanism.

Affordance 3: Listeners can address comprehension problems when interacting with AVP controls.

Effective use of AVP controls addresses comprehension problems. Cárdenas-Claros's (2020) study with 13 high-intermediate learners of English showed that fast speech rate affected comprehension. Twelve out of 13 participants in her study chose AVP controls and transcripts to overcome this difficulty. Similarly, Ozcelik et al. (2019) highlighted listeners' difficulties in a study with 28 A1 level participants. They identified problems related to process, learner, affect, input, social nature, and task. The participants used AVP controls to verify comprehension and compensate for speech rate. By the same token, Liou (2000) investigated 20 college students learning English as they interacted with a fit-for-purpose computer-based program. Liou noticed the participants in her study interacted with AVP controls after interacting with textual support. Liou (2000) speculated that her participant's decision could be the result of learners' lack of vocabulary.

Affordance 4: Listeners can enhance listening performance with AVP controls.

Research has also provided evidence on how listening comprehension

can be improved as a result of interaction with AVP controls. Shalmani (2008) examined 200 upper-intermediate participants and reported that learners who interacted with transcripts and AVP controls showed comprehension gains. Likewise, Tan et al. (2021) noted improvement in listening comprehension as a result of not only interaction with AVP controls but also the use of metacognitive strategies. Ozcelik et al. (2020) research shed light on significant differences in the frequency of listening breakdown repairs between participants who interacted with AVP controls and those who did not have access to them. O'Bryan and Hegelheimer's study (2009) concluded that input repetition controlled by AVP controls plays an important role as it allows learners to associate vocabulary and grammar to understand a text, leading to the development of more elaborated bottom-up strategies. Rodrigo (2017) also found that input repetition positively affects listeners from different levels (low, medium, and high). In this study, 48 participants listened to an oral passage completely three times without stopping and at their own pace. Rodrigo (2017) reported comprehension gains in participants from the three groups and concluded that input repetition boosts comprehension regardless of proficiency. McBride (2011) reported that learners provided with access to AVC buttons and were able to control the speed and pause buttons showed improved performance in their listening comprehension tasks.

Limitation 1: Proficiency level limits learners' use of AVP controls.

Language proficiency influences listeners' interactions with AVP controls. In this regard, Hegelheimer and Tower (2004) found that low-proficiency learners relied more often on dual input (transcripts and AVP controls) while high-proficiency learners relied exclusively on audio repetition. In Hegelheimer and Tower (2004), "higher proficiency students preferred options that actually helped them with correctly responding to tasks as opposed to lower proficiency students, possibly based on the misperception that more input is better" (p. 202). In a similar vein, Roussel (2011) reported a relationship between language proficiency and AVP controls use. Participants with higher proficiency exhibited a tendency to neglect AVP controls, if unnecessary for their comprehension purposes. Conversely, low proficiency participants displayed inefficient use of AVP controls or completely neglected them. Grgurović and Hegelheimer (2007) also identified that low proficiency learners neglected the use of the AVP controls associated to the video. Ozcelik (2020) reported that low proficiency learners in his study were not familiar neither with collaborative tasks nor with self-regulated listening tasks using rewind, pause and forward controls in their foreign language classes. Therefore, AVP controls were used primarily to keep pace with the speed of delivery.

Limitation 2: Learners need training on AVP controls usage. Listeners need to be trained to use AVP effectively. As reported by Cárdenas-Claros and Gruba (2014) and Cárdenas-Claros et al. (2021) working in six different sessions, AVP controls went from being sporadically used to being better regulated after time and regular interaction, and this was attributed to the regular questioning of

why and how AVP had been used. Grgurović and Hegelheimer (2007) also suggested a need for learner training after working with 18 intermediate ESL learners. Their study aimed to identify whether subtitles or transcripts improved comprehension gains. Subtitles were synchronized with the video which was controlled by play, pause, rewind and fast-forward buttons. Grgurovic and Hegelheimer (2007) reported that low proficiency learners tended not to use help options and therefore they encouraged training on help options. Roussel (2011) and Cárdenas-Claros and Gruba (2014) also underscored the importance of learner training to promote planned interactions and informed decisions to reap the benefits of interaction with AVP controls.

Discussion and implications

This systematic review sought to analyze empirical studies examining AVP controls to identify research trends and highlight pedagogical implications. The studies reviewed show the current and diverse interactions between learners and AVP controls. Learners' interactions with AVP controls vary because of the types of strategies that listeners display when working in computer-based listening tasks. In this sense, metacognitive strategies seemed to be very effective in orienting learners to address their cognitive demands effectively through AVP controls interaction and thus achieve their listening goals (Roussel, 2011; Tan et al., 2021). Notably, metacognitive awareness was seen to foster learning autonomy and computer-based language learning environments provide learner control of the input. Thus, these two complementary approaches may be critical for listening comprehension development. Then, curriculum and syllabus designers and English teachers should promote the use of AVP controls in tandem with a metacognitive approach to listening instruction.

Another finding that emerged from this systematic review was that some learners may already come with a strategic mindset and make use of AVP controls accordingly. In other words, some listeners exhibited a clear preference for avoiding interaction with AVP controls the first time they were exposed to the input, and left AVP controls' use for subsequent exposures (Cárdenas-Claros, 2020). In contrast, other listeners exhibited a compulsive interaction with AVP controls (Pujolà, 2002; Rivens-Mompean & Guichon, 2009; Roussel, 2011). This suggests that as listeners make use of the learner control afforded through AVP controls, some kind of strategy assessment is needed in order to identify if their preferences match performance. In light of this, the teacher's role would be pivotal to successfully channel listeners' efforts, especially when they interact with AVP controls inadvertently.

In fact, learners' reflections on their listening process through questionnaires or interviews (Cárdenas-Claros, 2020; Grgurović & Hegelheimer, 2007) acknowledged how different AVP controls assisted them for varied purposes. Hence, learners' self-assessment of their listening development might be a tool that should be considered when arguing in favor of the positive effects of replay buttons for listening comprehension. This implies that not only data

from competence tests reveal listening improvement, but also learners' perceptions and attitudes on the positive effects of input repetition.

These systematic review results also suggest that when there is a lack of training on help options, students resort to intuitive learner control by choosing only the sort of input enhancement they are familiar with (Cárdenas-Claros & Gruba, 2014; Grgurović & Hegelheimer, 2007;). Then, it might be argued that learners' listening skills would greatly benefit from exposure to pedagogical interventions which require AVP controls to be used in particular listening tasks and in which said controls are progressively introduced to learners. Additionally, we found that proficiency level may influence learners' decisions at the moment of interacting with AVP controls. Low proficiency learners relied on dual input (transcripts and AVP controls) and higher proficiency ones on repeat buttons (Hegelheimer & Tower, 2004).

Pedagogical suggestions

A valuable contribution of systematic review as a research design is the provision of guidelines for future research and pedagogy (Depraetere et al., 2020; Gough et al., 2012). In this study, we propose a set of pedagogical suggestions to improve L2 listening education.

1. Encourage students to use AVP controls together with other help options. Researchers highlight reading off transcripts and replaying texts since they not only facilitate input comprehension (Shalmani, 2008), but also allow listeners to deal with fast speech rates (Cárdenas-Claros, 2020) and increase opportunities to develop word segmentation skills (Cárdenas-Claros & Campos-Ibaceta, 2018). Notably, interaction with transcripts and subtitles together with AVP controls is recommended in-class tasks, but also with captions and subtitles for extensive listening (Grgurović & Hegelheimer, 2007).
2. Guide students to set up clear goals before interacting with AVP controls. The purposeful interaction with AVP controls helps learners overcome listening difficulties. Vandergrift and Goh (2012), Cárdenas-Claros (2020) and Rodrigo (2017) stress the benefits of input repetition for comprehension. Then, guiding learners to plan their AVP controls' interaction may allow them to take proper advantage of them and avoid overuse or ineffective use.
3. Implement metacognitive awareness raising activities when working with AVP controls so that learners are able to plan, monitor, and evaluate their interaction with them. Instructors should present students with tasks that require help option interaction and observe this process to foster an effective use of learning strategies (Grgurović & Hegelheimer, 2007). Tan et al. (2021) promotes a metacognitive approach in listening tasks to provide learners with strategies to regulate their listening processes and improve their listening comprehension.
4. Take into account language proficiency when modeling the use of AVP controls (Cárdenas-Claros & Gruba, 2014) as this can lead to successful

listening. Poor listeners would benefit directly from the provision of teacher guidance as learner control may be overwhelming for them (Roussel, 2011). In contrast, advanced listeners would require more freedom in choosing help options to develop their listening metacognitive strategies (Roussel, 2011).

5. Prompt students to take advantage of learner control provided through interaction with AVP controls. AVP controls allow learners to process input at their own pace (Rivens-Mompean, 2009). Moreover, repetition granted by AVP controls aids the development of listening skills (Cárdenas-Claros, 2020; Vandergrift & Goh, 2012). Then, teachers should encourage unrestricted access to pause, rewind, and forward buttons (Cárdenas-Claros & Gruba, 2014; Cárdenas-Claros, 2020) either in class tasks or extensive listening (Ozcelik et al., 2020) since repetition provided by these control buttons create a natural environment and instance for L2 input processing (Rodrigo, 2017).

Conclusions, limitations and avenues for further research

The main limitation of this systematic review is that most of the investigations retrieved were aimed at researching other types of help options where audio/video playback controls remained a secondary objective. Therefore, the number of studies conducted specifically on the use of AVP controls is quite narrow, resulting in a limited investigation, yet still valuable for the field of research. Additionally, our results align with Plonsky's (2023) findings that research designs in CALL tend to be done with small samples, overfocus on English, and undergraduate students.

To conclude, current research investigating learners' use of AVP controls shows that listeners resort to a number of strategies. Additionally, while some listeners use strategies purposefully, others tend to use AVP controls indiscriminately and some learners change strategies and interaction patterns as they familiarize themselves with the learning environment. Additionally, the studies above show that AVP controls can compensate for limitations in comprehension due to input text characteristics. This assistance enabled listeners to achieve their listening goals resulting in enhanced performance. The reviewed studies also suggest that language level may influence learners' decisions at the moment of using AVP controls and that training on AVP controls is necessary as it may have a direct impact on their effective use.

Clearly, future research needs to explore the effects of AVP controls on listening performance to strengthen the body of literature that could inform future teaching practice. It would also be interesting to conduct studies with students from language backgrounds different from the ones investigated so far and with target languages other than English. Also, as the examined studies were conducted in controlled environments or even if they were qualitative, they were not observed directly in classrooms, further research could examine the use of AVP controls in actual classrooms to evidence if and how learners experience and benefit from interaction with AVP controls.

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